

MIKRO-
KOSMOGRAPHIA
—
CROOKE

1631







1686

424 RARE OLD MEDICAL.—MIKPOKOS
MOTPATIA; a Descript. of the Body of Man;
together with the Controversies thereto
belonging, &c., by HELKIAH CROOKE, Dr.
of Physicke, WITH THE FINE OLD ENGR.
COMPARTMT. TITLE, shewing various opera-
tions in progress, &c., and all the curious
copper-plt. vigns. on text, thk. fol.,
contemp. hf. bndg. (covers detached) (size
of ll. 13 by 8½ bare), very fair copy,
1631

Quite perfect as regards text, and has the leaf
of ERRATA at end. DEFECTS:—Slightly water-
stained in places, and top blank mgn. of engr.
title needs reinforcing, as do the lower blank
mgn. of the last leaf of text, do. of Index,
and do. Errata (foxed). AT THE END is:—
An Explanat. of the fashion and use of 53
instruments of Chirurgery, by same author,
with separate vign. title and copperplt. cuts.
The book is dedicated to the Worshipful Co. of
Barber-Chyrurgeons.

STC 6063



1686

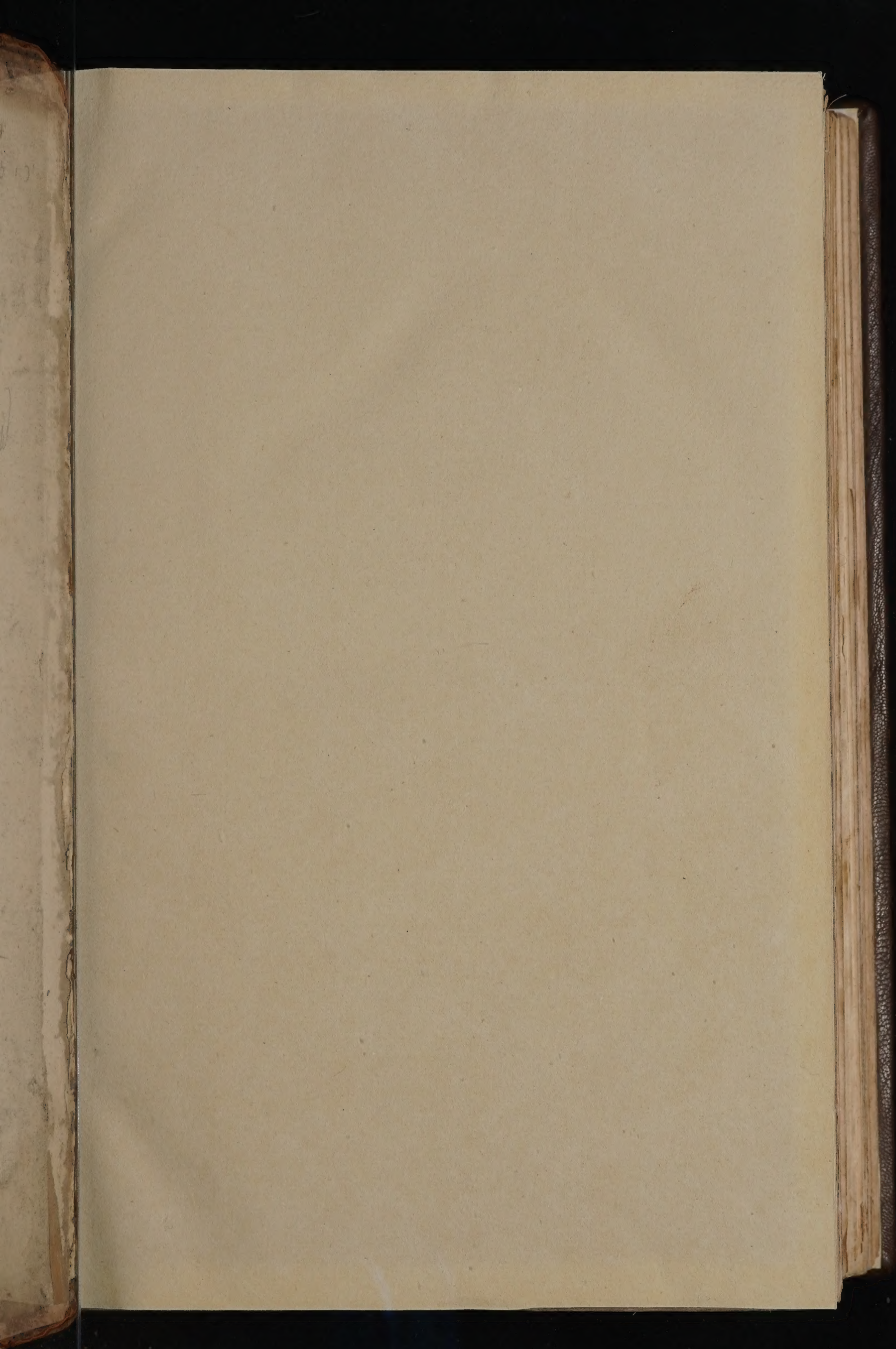
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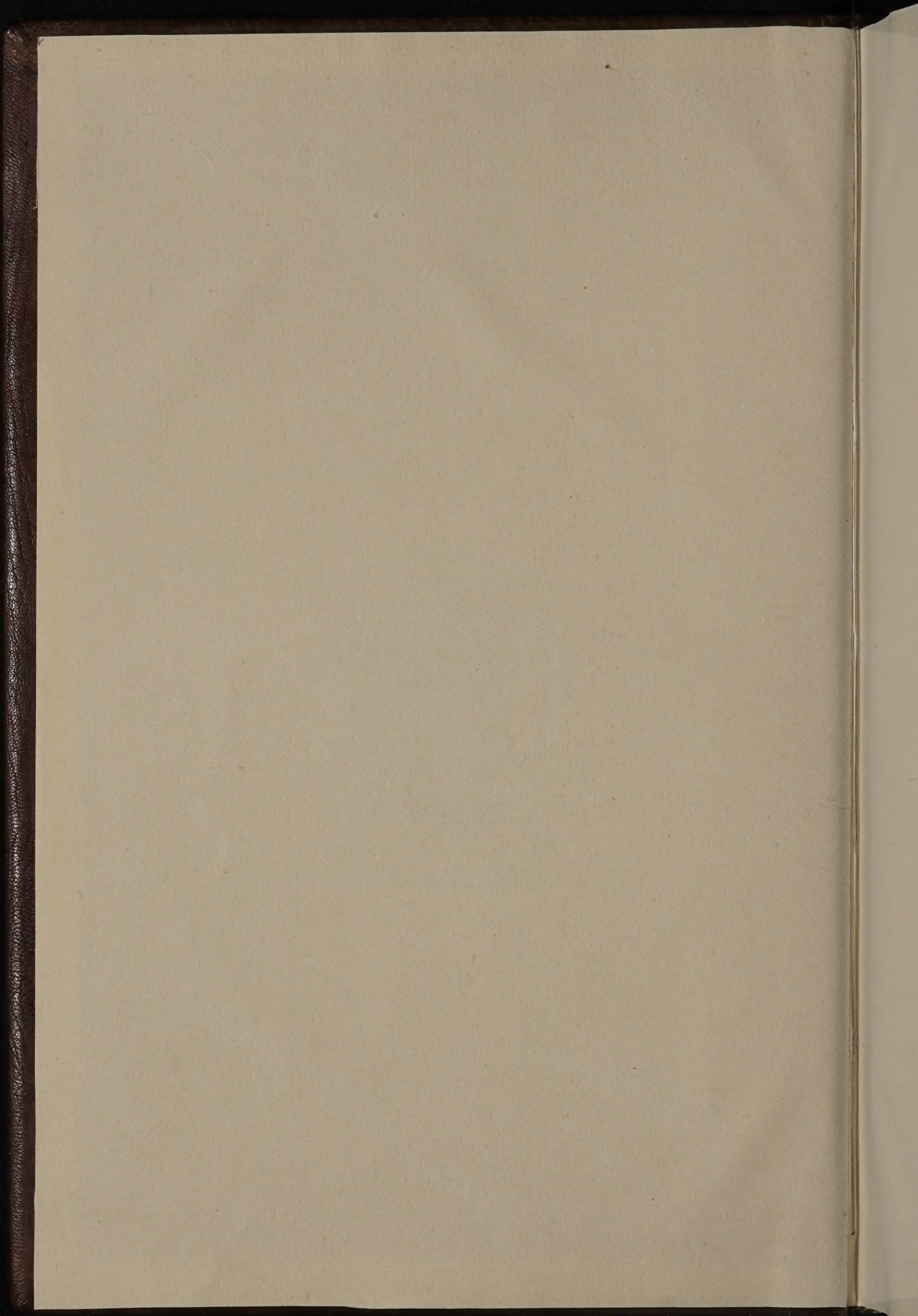
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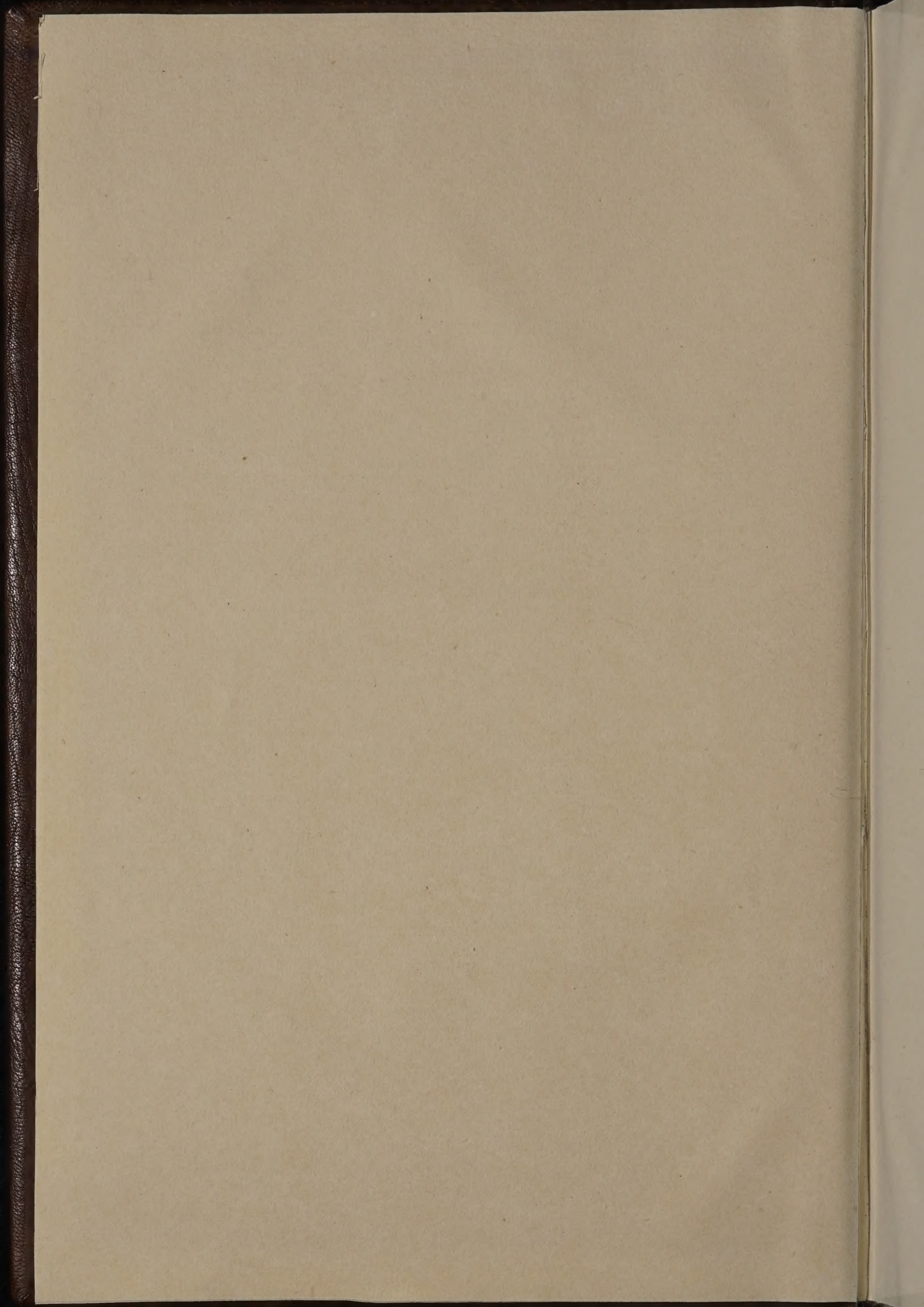
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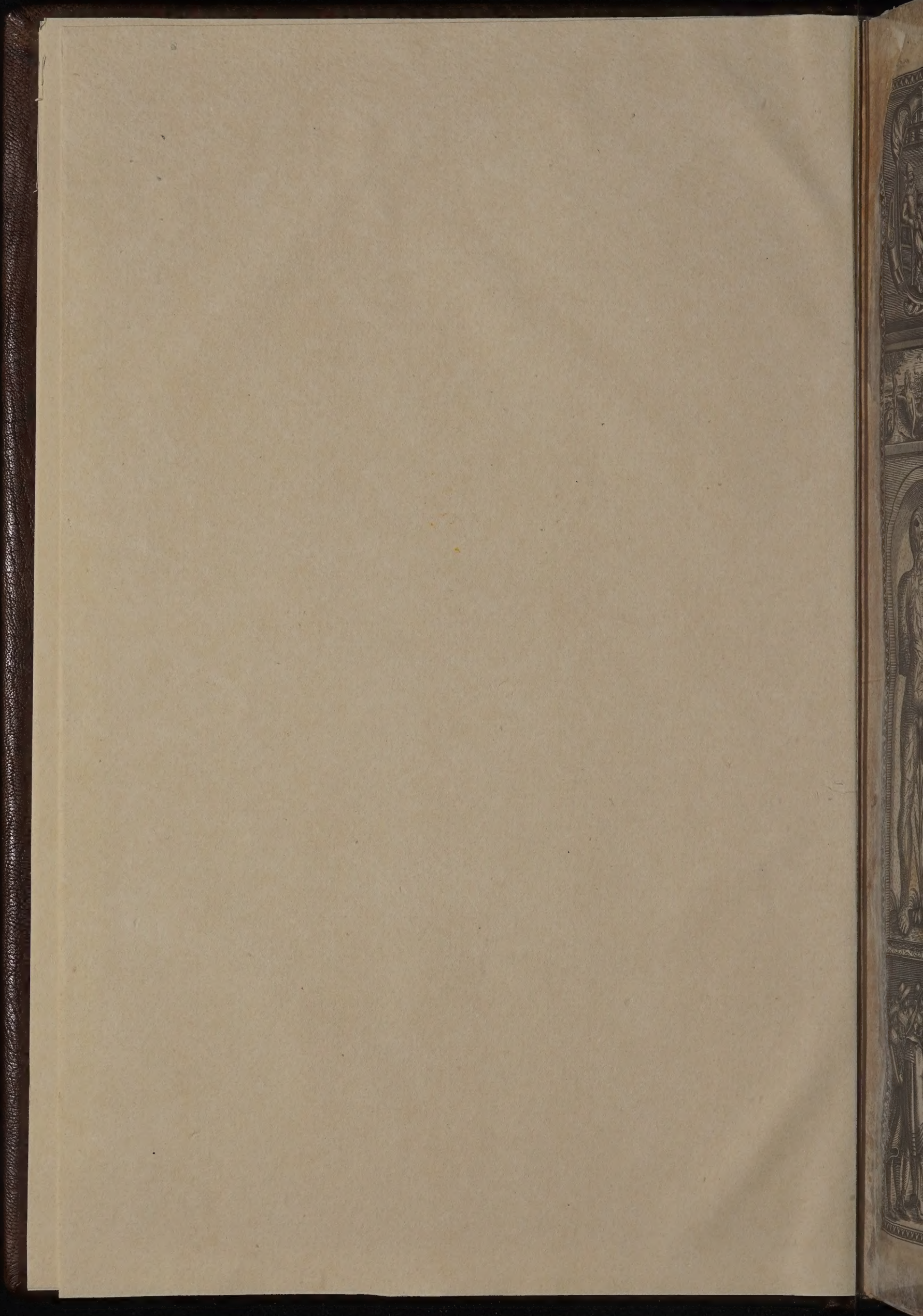




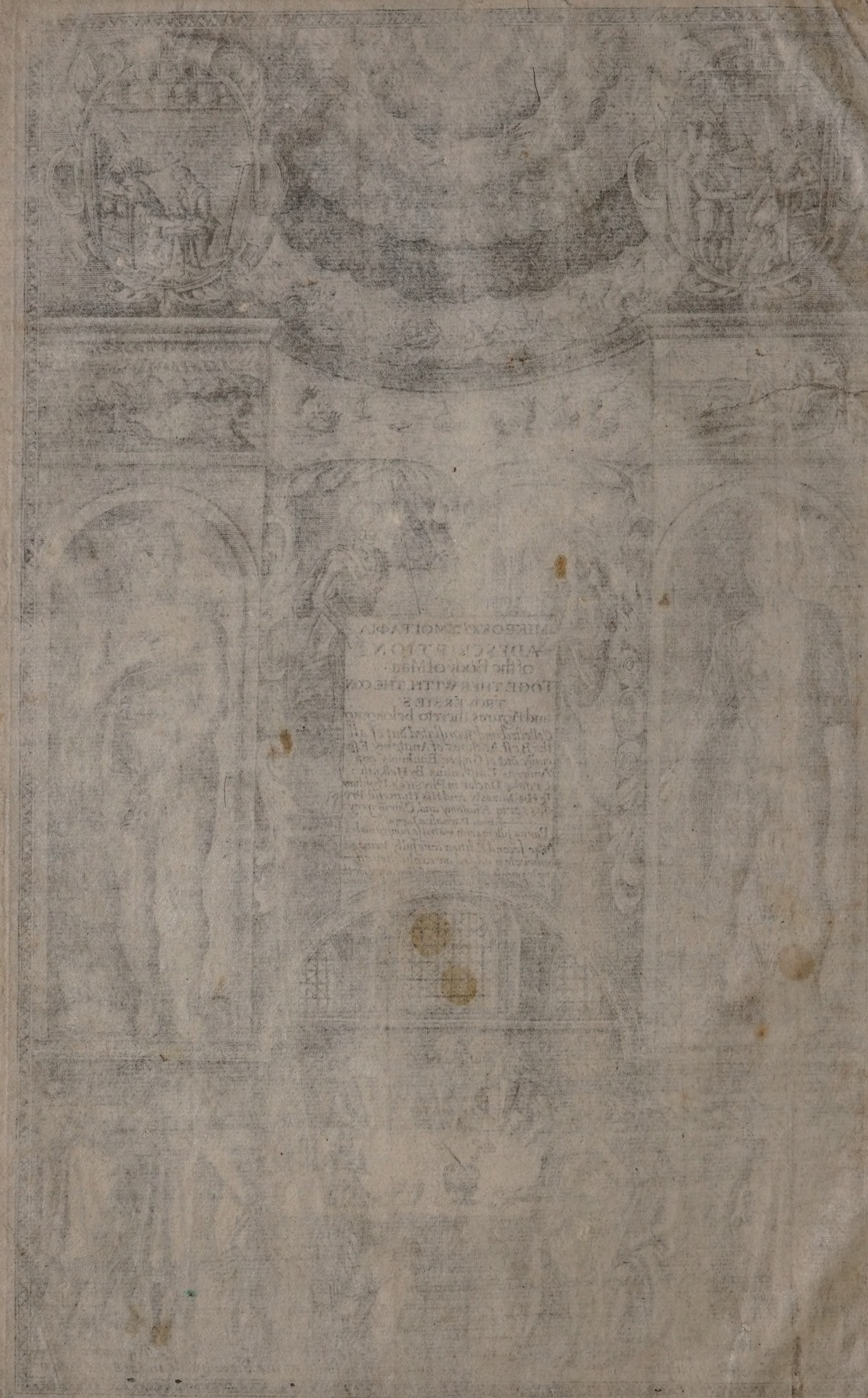












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ΜΙΚΡΟΚΟΣΜΟΓΡΑΦΙΑ.

A
DESCRIPTION
of the Body of Man.

WITH THE CONTROVERSIES
THERETO BELONGING.

Collected and Translated out of all the Best Authors of Anatomy, Especially out of Gasper Bauhinus and Andreas Laurentius. By HELKIAH CROOKE Doctor of Physicke.

Published by the Kings Maiesties especiall Direction and Warrant according to the first integrity, as it was originally written by the AVTHOR.

The second Edition corrected and enlarged.



Printed at London by Thomas and Richard Cotes, and are to be sold by Michael Sparke, dwelling at the blue Bible in Greeces Arber, 1631.

DESCRIPTION

of the Body of Man.

WITH THE CONTRACTIONS

OF THE MUSCLES.

By WILLIAM SMITH, M.D. F.R.S. &c.

Author of the 'Anatomy of the Human Eye' &c.

London: Printed by J. Smith, 1789.

The Author's Address is at the 'Anatomical Theatre' in St. George's Hospital, London.

82401





SERENISSIMO POTENTISSIMO LI-

TERATISSIMOQVE PRIN-

CIPi AC DOMINO NOSTRO

IACOBO, DEI GRATIA

Magnæ BRITANNIÆ, Franciæ

& Hiberniæ REGI, FIDEI DE.

FENSORI, &c.



T fuscepti moles operis, cui vix
cuiusvis nostrorum hominum vires respondent, &
inassueta scriptioni manus, merito me, dum rem pa-
rarem, deteruere quo minus Augusto tuo nomini
inscriptam vellem; Rex serenissime & tui seculi
longe literatissime, ita demum conscientia animi
integri, sed quorundam (quos minime decuit) ob-
trectatione tentati, ad eam me impulit recte facto-
rum fiduciam, vti primum libenter ad tuâ Maiesta-
tem prouocauerim, quem fælicitas Publica, cum primis Literaria, non Orbis
modo nostri, sed & *ἡ γυμνασιαρχία* Imperio admouit. Enimvero vt taceam eam
quam exteræ Gentes in Tuis egregie scriptis amant & admirantur *πολυμαθία*
σίαν; interior illa *πολυμαθία* quam ante annos aliquot in altera, nouissime in
Cantabrigiensi Academia publicisq; Comitijs sub tuis Auspicijs habitis, sig-
natam exhibuit Maiestas tua; non sinit me dubitare litem hanc de re litera-
ria Tuo Tribunali ordinariè competituram. Duo igitur sunt quæ huic ope-
ri affigunt si non affingunt crimina, mihi ipsi tertium. Primum idq; maxi-
mum, nefas esse ducunt Artis Mystèria ignobili vulgo prostituisse. Secun-
dum, velamen Naturæ reuelare & Pudicitiam quasi in propatulo ponere.
Tertium illiberalis esse ingenij arguunt in aliena quercu lignari. Quæ sin-
gula quidem amoliri, vt mea plurimum interesse sentio, ita supplex obte-
stor Maiestatem tuam, pro eo, quo coronatæ incedunt virtutes tuæ, Can-
dore vt tantisper tua tempora demorer dum totidem momentis molimen-
ta isthæc diruam. Atq; primum me mouit non modo scriptorum Veterum
Græcorum, Latinorum, Arabum recepta consuetudo, qui ad vnum omnes
Artes quisq; suas cuiusvis generis indigitarunt; sed & Neotericorum scho-
la Medicorum, qui Patrio Idiomate vel primum donarunt inventa Anato-
mica vel postea traduxerunt; cuius rei locuples mihi testis est pars quæque

Europæ maxime literata, Hispaniam dico, Gallias, Italiam & vtramq; Germaniam. Neq; vero in nostra Anglia filuit hæc Musa, aut postliminio tantum recepta est, sed superiori seculo nata, sub Patre, Filio, Filia, potentissimis & literatissimis Principibus ter quidem instaurata, sed destituta fomentis in Cunis adhuc vagire deprehenditur: siquidem vt vrbium Imperiorumq; ita literarum sua sunt & lenta tempora quibus oriuntur, florent, senescunt & tandem intereunt. Taceo illa, maxima quidem, sed commemorata nobis libro primo rationum momenta, quibus ab utilitate, a voluptate, a necessitate ipsa, quotquot mortalium sumus, cogimur, trahimur, allicimur in Communionem Naturalis Sacramenti summæ Magni Opificis sapientiæ et bonitatis. Quis ora erecta dedit & oculos versi-colores? quis narium perforationes & sinuosas aurium tornauit Cochleas? quis venarum arteriarumq; riuos & aquæ-ductus distribuit, nervorum terendit rigiditates, ossium ^{θερελινον} posuit, cutis efflorescentiam & membranarum expansa dilatauit? quis artus artuumq; digitos diuisit, firmavit pedes, poros & spiracula terebrauit? quis excauavit pulmonum Bronchos spiritusq; reciprocationes instituit? quis motus cordis geminos, intermediam quietem, & conclusæ vitæ subsultationes pulsusq; limitauit? quis viscerum coagulavit conglomerata Parenchymata? quis Sensuum ^{αισθησεις} Animæ Regiam stipavit, Cerebrum Falce diuisit, arcuatam Concamerationem medullæ, speculumq; lucidum disposuit? quis spirituum Animalium determinauit conceptacula, reticulum mirabile plexumq; Choroidem innexuit? Dies me deficeret si ventriculi Chylosin, intestinorum volumina, Mesaraicarum suctus, hepatis sanguificationem & Anastomoses mirabiles, si lienis defæcationem, renum emulctus, vesicarum collectiones, testium irradiationes, vteri sensus, & mille artes Naturæ minimis particulis ingenitas prædicem: quæ si non singula, at præcipua tamen novisse, cuius Deus bone non intererit? Circumgerimus ignota miracula & sectamur quisquiliis, extra nos quærentes dum domi peregrinamur.

At obsignata, inquiunt, Mysteria Arti reverentiam, Artifici dignitatem pariunt. Scilicet, is semper mos fuit hominum vel illiteratorum, vel quæstui inhiantium, Religiones Artesq; tanquam scrinio conclusas gerere, ne vel foedæ argui possint inscitæ, vel emolumenti tantillum sibi detrahi sinant: quanquam si legitima virtutis præmia spectent, non aliunde cumulatus nostri ordinis hominibus subministrari sentiant; quam ab ijs, qui vel leuiter initiari vanos etiam metus expavescunt, vel altius instituti fidam Artem vt agnoscunt, ita cum opus est exposcunt & amplectuntur. Sed si neq; veterum calcare viam, nec recentium laudabili instituto insistere velint vt illorum obsequi possint voluntati, quos vel diversa studia vel occupationes a literis alienæ minus idoneos reddiderunt qui rigidam Anatomicorum orationem percipiant; at certe Iuuentuti Chirurgicæ ne inuideant, qui cum de nostra Repub. Colonia sint, æquum est eas leges, ea iura teneant quibus & sibi decori, & nobis, dum res est, vsui esse possint: Qui idcirco non ingenio Stromatico instituendi, aut Cothurnatis Cissionijsq; crepidis induendi, sed per genuina Artis præcepta facili methodo deducendi, vt quæ domi vel suo Marte, tēporum injuria, vix consequi possunt, nostra
opera

opera sibi abunde suppeditata cognoscant, eaq; ita mitigata vt possint concoqui. Neq; enim vbiuis terrarum Doctores Medici ad-sunt, aut Cuiusuis fortunæ est stipendium Medicum numerare; an igitur necessum habeant perire eos omnes quorum vel res angusta vel habitatio a Medicorum frequentia seclusa est?

At saltem secreta Naturæ reuelanda non sunt, neq; auribus oculisue obijcienda quæ male feriatorum mentes & pascant & incendunt. Veniunt hic mihi primo loco repetenda quæ dudum adduxi de consilio omnium Seculorum, Nationum, Hominum, quorum nemo harum partium Historiam detrectauerit; de admiranda Diuini Creatoris in his iisdem partibus sapientia; de Administrationum circa easdem necessitate, quæ eo magis urgere soleat quo symptomata plerumq; inducunt vt grauiora & tristiora ita maxime frequentia. Quid quod Scriptura sacra *Rachaelis* Memes, puerperarum profluvia, Carnis saluationem in Gonorrhœa, semen Concubitus *Sare* *καὶ τὸν ἀνδρὶν ἀποκρίνας* quam admodum violenter, inquit *Stephanus*, seminis Conceptionem pro Emissione interpretantur, describere non erubuit. Attribuendum est aliquid pudicitia. Certe quidem & nos non parum tribuimus, & quoad fieri potuit, re non neglecta quæ sub manibus erat, honestis Circumlocutionibus argumentum molle exasperatum reddimus; vbi proposito insistendum erat, Philosophica (disputatione Lectoris mentem in diuersum trahimus, *Ne vati noceat mala lingua futuro*. Icones non aliæ sunt quam quæ nostro hoc seculo centies impressæ vbiq; terrarum circumferuntur, pijs Principibus & Rebus pub: approbatæ; non aliæ quam quæ virgini castissimæ *Elizabethæ* sacro-sanctæ memoriæ principi Dedicatæ & in manus traditæ sunt.

Deniq; dignitatem mihi exprobant Academicam quod aliorum vestigijs insistens de alieno prodigus de proprio parcus fuerim. Neq; sane diffitebor me sanguinem succumq; hausisse ex alijs; at Methodum, Limina, Limamq; nostra vico, insuper quæ sæpenumero in Disquisitionibus occurrunt partes meas. Addidi etiam plurimorum Anatomicorum *διαχωρίσους*, suffragia, retractationes, demonstrationes *ἐξιδιούσους*: quæ omnia vel colligere, vel collecta repetere vnde desumpta sunt & suis quæq; locis disponere non nudi est Tralatoris; quanquam fuerunt & inter nos sunt viri valde docti quorum diuina longe sequor & vestigia semper adoro, quibus transferendi munus fastido non fuit.

————— *Etiam Parnassia Laurus*

Parua, sub ingenti matris se subijcit Umbra.

Neq; hoc mihi jure quis audaciæ loco imputauerit si remigem prius esse me velim quam ad gubernacula manus admouerim, neq; socordia si proprio utar remigio. Atq; nisi ego fallor, si quis in hoc curriculo mecum desudauerit & pedem pedi contulerit; sentiet profecto se *ἐπὶ ὁλοσθησὶ ἀδὲς σαρδίοσπομῶν*, ita præcipitijs & præruptis anfractibus totus hic ager scatet. Mitto viscerum viam perplexam & spinis obsitam, quæ tot artis proceres collisit: quas va-
forum

forum Conjugationes, quæ diuortia, quam implicitas diuinationes, timari, sequi, & in suos alueos deducere oporteat? Musculorum nomina, originēs, progressus, implantationes; Substructorum ossium appendices, processus, perforationes, suturæ, harmoniæ, gomphoses, diarthroses, synarthroses, enarthroses, arthroidiæ, ginglymoi; eorundem synchondrosis, synsarcosis, syndesmosis, & mille tedia superanda sunt; immensum maris æquor arandum, antequam fugientem oram prehenderis.

Artem tracto tentatam quidem ante me, sed subsultim & leui pede, ab ijs quorum voluntates probaueris potius quam facultates, qui tamen cum primum ad vexillum fuerunt, merito suo Primipili a me audient. In nostro opere fidem inuenies & indefessam diligentiam; orationem, non illam quidem ornatam (qui poteram in abrupta re?) sed evidentem & dilucidam; verborum etiam delectum, sed non tam quæ delectet quam quæ instruat, quamquam & ipsa Artis vocabula adiunximus, sed reddita, vt apud me lector seipsum, apud alios, istos ipsos intelligat.

Atq; hactenus consilij mei rationem, ita vt teneor, exposui, quod vt Majestatis tuæ bona cum venia sit humillime & obnixè contendo. Faucas primitijs crescentis Indolis, quæ si sub tuo Sole adoleuerit & iustam tandem maturitatem consequuta fuerit, non indignos fructus retributuram confido. Interim a Te pro meo opere ^{deus}, pro Te a Deo

Opt. Max. ^{τοῦτο πρὸς τὴν εὐδαιμονίαν} ^{supplex} efflagitabo.

Serenissimæ Majestati tuæ

Subditus Deuotissimus,

HELKIA CROCHYS.



SERENISSIMO
POTENTISSIMOQVE
PRINCIPI AC DOMINO
NOSTRO CAROLO, DEI GRATIA

Magnæ BRITANNIÆ, Franciæ & Hiberniæ
REGI, FIDEI DEFEN-
SORI, &c.



Vi Liber à Patre tuo Diuini ingenij Principe
olim asserebatur, idem, siue emolitâ siue emol-
litâ Inuidiâ, votisq; vulgi non vulgaribus de-
nuo requisitus, postliminio jam redit exutâ labe
renouatus; Repetitq; Auspiciū à te CAROLE
Rex Inuicte: simul hoc, testatam vt habeas a me
et perpetratam voluntatem inseruiendi (pro mea tenuitate)
Studijs Compendioq; tuorum.

Quas vires, quosq; progressus sub Patre tuo Teq; Principibus
Artes omnes sumptuerint fecerintue, testis est non Tua solū
Britannia sed Terrarum Orbis. Taceo reliquas, in Nostra Me-
dicina, Res Pharmaceutica ante annos aliquot publico Collegij
nostri consilio instituta, Regia Authoritate dudum stabilita est.
Medicinæ praxis ejusq; Apparatus omnis ante Seculum Curia-
tis Comitij ægregiè substructus, vitium nondum fecit; præter-
quam quod Leguleij aliquam-multi, Acuti scilicet Actionum
Præcones, Cantores Formularum, syllabarum Aucupes (Ci-
ceronis hæc Elogia sunt) qui linguam contra jus fasq; venalem
habent et prostitutam, dum Edicti euoluunt plicaturas, om-
nem Litigandi Articulum vexare soleant. Pars Anatomica
illustrata quidem est à me isthoc opere, sed penitus ab Har-
veyo

veyo tuo, viro ingeniosissimo juxta & oculatissimo culta & locu-
pletata : Sola Chirurgia Idiomate nostro inculta adhuc jacet,
quam tamen si Tu erectam velis ac jubeas, non deerunt credo ex
tuis qui eam ex hoc veterno strenuè impigrèq; et moliantur et
vero asserere valeant. Vna Arundo eaq; læthalis hæret adhuc
Medicæ Artis lateri, sed & non minus ea Pestis salutis publicæ
insidiatur; insanam Empericorum audaciam volo. Gens illiterata,
illiberalis, temeraria, male-suada, ne durius (Tuam Celsitudinem
reueritus) dicam. Hanc tu compesce Optime Regum,
vnaq; existimes, Te non tam nobis Medi-
cis quam publicæ incolumitati
consultuisse.

Serenissimæ Majestati tuæ

Subditus Deuotissimus,

HELKIAH CROCVS.



TO THE WORSHIPFULL Company of the Barber-Chyrurgeons, the

Maister, Wardens, Assistants, and Comminalty of the same;

HELKIAH CROOKE, Doctor in Physicke, wisheth

Happie and prosperous Successe in Your

PROFESSION.



Y Maisters and Worshipfull Friends. As from the first I intended this Labor vnto your behoofe; so now hauing by Gods assistance brought it to an end, I offer it vnto you as a token of my Loue: Not that I doubt, but there are some among you who as themselues stand in no neede of my helpe, so they are also able to haue set out this Banquet with greater variety and to haue Cooked it fitter for you as being better acquainted with your diet and appetites. But because it is now a long time since your Banister (that good old man) first presented you with a seruice of this kinde, and no man hath seconded him; I haue aduentured to commit vnto you these my first frutes, which if you shall kindly entertaine and make such vse thereof as I may not thinke my labour misbestowed, you shall encourage me cheerefully to run on that course which I haue propounded to my selfe to further your profiting in that Noble Art which you haue taken vpon you to professe. For when I first began, I intended the Anatomy to be but an entrance into a worke of Chyrurgerie which I had digested into a forme fit, as I thinke, first to ground and establish you in the Principles and Theory or Contemplatiue part of your profession, and after to builde you vp vnto the practise of the same. And because the Body of Man is the Subiect of your Art, without the knowledge whereof it is impossible for a Chirurgeon to worke with any confidence or certainty of successe, I began with Anatomy.

In the next place may in time follow a Discourse of the Constitution of mans body, as he enioyeth a perfect or apportionated health by a due Mixture of the principles whereof he consisteth; of the Temperament of each part arising from that mixture; of the Offices or Functions proceeding from that Temperament, and such other things as will fall in with the same. For as it is a rule in Geometry, that Rectum est index sui & obliqui, That which is Right measureth both it selfe and that which is crooked; so in our Art, he that knowes what should bee the naturall disposition of euerie part will be best able to iudge when Nature declineth from that integrity, and how far the declination is from the true and genuine constitution. This part indeede is Philosophicall, but it may be made so plaine, that a very reasonable capacity shall be able to apprehend it. After you haue knowledge of the healthfull and sound constitution which is the rule of the rest, you must be taught the Natures, Differences, Signes and prognosticks of diseases, so farre as is necessarie a Chyrurgeon should know, that is to say, of Tumours or Apostemations, of Wounds, Vlcers, Luxations, Fractures, and the like. Then followeth

The Preface to the Chirurgians.

loweth the Method of Curing by Indications, which are many and intricate, but yet they may be referred not (without great labour) to outward diseases & illustrated all by examples to make the better impressiō in your minds. In the next place I should come to the operations of Chyrurgery in generall, whereto all the Instruments of your Art doe belong; Engines, Swathes, Ties, Bands and Ligatures, described by Hippocrates, Galen, Oribasius, and those also of the new Chyrurgeons inuentions, with their Figures, interpretations, and manner of application. Afterward the operations in particular, as Division, Simple and Compound; Simple in Section and Vstion; Compound with Extraction and Extirpation. To Junction also Simple and Compound, Simple in Adduction, Adaption and the way how to Containe them so fitted together. Compound with Addition of such decayed Naturall parts as may be restored or imitated by Art. Then comes the cure of Tumors of all kinds both Simple and Compound; of Wounds whether they be made Cæsim or punctim, by Contusion, by Arrowes, Engines or Bullets, with Laceration or without: of the bytings or stinging of venomous Creatures, with their seuerall Antidotes: of burnings, scaldings, and such like.

Next is the doctrine of Vlcers, putride, sordide, fistulated, cancerous, gangrenated, sphacelated and such as are virulent, with the Accidents that vse to accompany them: of Luxations also and Fractures with their kinds and accidents. Afterward of those generall diseases which belong to the whole body, as the Gowt, the Leprosie, the Meazels, the Pox of both kindes, the Plague and such like: and then of the particular diseases from the Head to the Foote, wherein the Chirurgeons helpe is required. Finally, of the Matter of Chyrurgery, that is, of the Nature of those Drugs, Hearbs and Minerals which he hath neede to vse; of their correction and preparation, and of the manner of compounding his Medicines. For I conceiue of the Art of Chyrurgery as of a part of Physick; and therefore of Chyrurgeons as Citizens of the Physitions Common wealth: the difference is, that wee hauing most what better meanes by education to aduantage our wittes, apply them vnto the more abstruse part of the Art separated from the sense and consisting in contemplation and collection; the Chyrurgeon worketh by his eye and with his hand, and dwelleth as it were in the Confinis of that Countrey whose inner part wee inhabit. If therefore they warrant the frontiers and keepe their Stations well and duly therein, may not we better attend to improoue the portion that is allotted vnto vs? But we are both like conetous Farmers, who incroach vppon and get more grounds into their hands then they can well manage, forgetting that wholesome counsell of the wise Poet:

Laudato ingentia rura—Exiguum colito.

Praise a great Farme but occupy a small.

For surely if we aduise well with our selues, Physitians shall find worke enough (though they meddle not with the labour of the hand) to minde the subiect of their Art, I meane Anatomy, wherein too many of vs are wanting to our selues and others; the causes of diseases; the signes of the part affected; the skill of prædiction; the method of curing and the choise of Medicines, with a world of intricate worke beside in apprehending occasions, expecting and imitating the motions and endeavors of Nature, remoouing her obstacles, strengthning her operation and the like. And if we want imployment in those, it seemeth to me more fit to fit our selues thereunto, then casting behind our backs the care of such needfull studies to take vp our precious time in dressing or attending broken heads, strained or luxed ioynts, new wounds or old Vlcers, or in playing the Apothecaries as some doe, who vnder the name of Cordials of x.li. an ounce, Potable Golde, precious

Quin-

The Preface to the Chirurgians.

Quintessences and preparations of Minerals, doe obtrude vpon the worlde either notable impostures or dangerous poysons, ayming indeede at nothing so much (if at any thing else) as at their priuate gaine and the concealing of their ignorance which would neseessarily be detected if they should communicate their practise to Apothecaries as other ingenuons Physitians doe. But of these I haue spoken more largely in an Animaduersion vpon Crollius his Admonitory preface in Latine, and shall haue fitter occasion to speake more elswhere, when I shall be very plaine against those that come in my way.

To retorne whence I haue digressed. Hippocrates the Father and Author of Physicke, the true paterne of ingenuity, put that for one clause in the Oath which himselfe solemnly tooke, and which he would haue all Physitians take, that they should not cut any man for the Stone, but leaue that worke for them that accustome themselues to performe it; as knowing he should finde worke enough to fit his minde for greater difficulties. On the other side the Chyrurgeon should content himselfe with the limits of his profession and not vsurpe vpon the possession of the Physitian, which he doth (sometimes indeede for his profit) but seldome without the detriment of the patient, especially if there be any difficulty in the businesse. I doe not deny, but that a Chyrurgeon, yea a Diuine, or Gentleman, if he lay good foundations and build thereafter vpon them, may be a Physitian as well and as good as the best of vs: but it is not ordinary for men of Manuary Trades or other professions to bee so qualified: the more honour it is for them that bee. But certainly if euery man would containe himselfe within his owne Teather, and presse no further then he is guided by right reason and his reason warranted by experience, we should not heare of so many solæcismes and notable incongruities as are daily committed in our Art.

Neither yet doe I thinke it fit, that the Physitian should be ignorant in the Chirurgical part, but able to guide the Chyrurgeon that is not able to guide himselfe, to assise and confirme him that is, and to amend a fault when it is committed: but for the worke of the hand, I take it to be more lawfull for him then expedient, more honourable to bee able and not to doe it, then profitable to do it though he bee neuer so well able. Albeit to say the truth, the fault is more common on the Chyrurgeons part then on the Physitians; and by so much the greater, by how much the danger of not doing well is more in very many, then the disreputation or disadvantage can be to a few (and very few they be indeede of the better sort) who do all they can.

Notwithstanding, because some men are importunately bolde aboue their skill, shall it not be thought fit that all may learne that they ought to haue skill in, and is an essentiall part of their profession? Let them then learne it (saith the Physitian) as wee doe. As much as if he should say to his patient that is not able to helpe himselfe: There is an excellent Medicine for your malady in Galen, I pray you seeke it out. It is indeede a disease in our common-wealth, that Chyrurgeons haue no better meanes to instruct themselues; If therefore (you will say) they meddle so much now, what will they not undertake when they are better provided? Surely not so much: for who are those that busy themselues most in the matter of physicke, but such as are least able? The able and discreete Chyrurgeon when hee hath learned anie thing hath also learned the difficulty of physicke, and will bee readier to pray in aide of the learned Physitian, then hee that runs boldly headlong without foresight of danger.

Seeing therefore it is necessary Chyrurgeons should be instructed for the behoofe of the Common-wealth, whose generall good is to be preferred before all particulars; why

The Praeface to the Chirurgians.

Should we not bee rather willing to instruct them our selues when wee may holde them within the compasse of their owne Art, then driue them to seeke other helpes to our preiudice? Now then, among all the parts of our Art there is none that the Chyrurgeon hath more neede of, or that is of more vse for himselfe then Anatomy, none that doth lesse inable him to practise physicke, it being a mere Naturall study, teaching him where to seeke the Veine he must open; how the ioynt should bee reposed which he findeth luxed; what parts are neare the wound which he searcheth, and therefore may be offended with it; which way the Fibres, Vessels and Tendons run, that in his incisions he may not violate them; how to cast on his Bands to containe a Fracture or Luxation; how to auoide the most sensible and vsesfull parts in Trepaning, Cauterizing, dismembring and such like: but of medicine and the cure of inward diseases in Anatomy not a word. The inward parts are also indeed Historified, whose position at least (you will grant vnasked) it is fit the Chyrurgeon should know; else when we appoint a plaister to the Liuer hee may lay it to the left side, when for the Spleen on the right. But he may be directed. That is not perpetuall; Physitians are not in all places, nor all men fit to entertaine them when they are to be had. Beside, a Chyrurgeon should not alwaies be an apprentice, but at length a Maister of his Art, fit to instruct others, not alwaies standing in neede of instruction himselfe, vnlesse it be in difficulties, when I know no Physitian but will bee glad of assistance. Add hereto, that all Physitians, in all ages, kingdoms and free states, haue written their Anatomy and Art of Chyrurgery in their mother-tongues, or afterward translated them for the vse of Chyrurgeons; which is so well knowne that it were in vaine to make repetition of particulars. To come to our selues; we finde many examples of learned men and good Patriots, who haue bene willing to take great paines and to be at great charge for this purpose.

Against the rest D. Cawdwell sometimes President of the Colledge of the Physitians in London, first translated Moores Tables, and (a learned man though hee were) was not ashamed to do that seruice to his country as to make himselfe, as some vnworthily and scornfully terme it, A bridge for asses to passe ouer by. Hee also promised Oribasius de Laqueis, which his labor seemeth to haue bene interrupted by his death or otherwise lost, to the great detriment of Chyrurgery. But for Anatomy hee did not onely take paines in it, but was also at great cost to cut the figures in Brasse, which he left remaining in your hands (my Maisters of Chyrurgery) as a testimony of his great desire to further your profiting in that part. Moreouer that honorable person the Lord Lumley erected a Chyrurgery Lector in the Colledge of Physitians, allowing liberall maintenance to a Doctor of Physick to reade the same twice a week, partly in Latin, and partly also in English for the vse of the Chyrurgeons, and to goe ouer the whole body of Anatomy euery yeare a part; which Lecture is not so duly followed and frequented, as it is performed at this time by D. Dauies, of whom I cannot but make worthy mention hauing receined not onely great contentment but profit also by his learned readings. You haue also among you a laudable custome to procure a Doctor of Physick to reade vnto you, and to provide that his Lectures be duly attended by those of your society: and the Physitians, I doubt not, thinke they haue done well in singling out a learned man to instruct you. Onely your care must be, to feed vpon that rather which is *idvqua*, then vpon that which is *idvqua*, vpon that which is good for nourishment rather then vpon that which will delight and fill but not feede your minds: to attend the plaine-song rather, then the diuision or descant, which doth oftentimes corrupt the Musick if the auditors

The Preface to the Chirurgians.

care be not carefull to distinguish them. Finally, you haue Anatomies both priuate for your profitting and publike for the honour and reputation of your Company read in your Mother tongue. And truly me thought it did me good to see so graue a company of gowned Chyrurgeons attending vpon it, so good order, so great a Crowne of worthy Auditors, so liberal entertainment at it: which I do not mention to flatter you, for flattery is to attribute more then desert, but partly to commend your praise worthy care; partly if it were possible to stir vp our selues to a lawfull emulation.

To returne. These many paternes, these worthy presidents first warranted me, after perswaded me to spend those houres which I might spare from my employments in these and the like labors. For which as I esteeme my owne profitting to bee a sufficient and answerable reward, so I did and do hope that my paines being communicated to others would returne vpon me with aduantage; that aduantage I meane, which is most welcome to honest minds, that is, a conscience of hauing improued though but a single talent. It were in vaine to Apologize for my selfe that I haue not had that time, those opportunities, those meanes which are required to an exquisit Anatomist, because (it may bee answered) I might then haue held my hand and giuen way vnto such as had them. There is indeed a time when a man should stand much vpon the consideration of his strength. There is also a time wherein it is lesse dishonor to want power then will, ability then good endeavour. He that first scales the battlements of a Castle or Citadell though his body bee not sufficient to oppose against a whole Squadron, yet if hee win the wall and make way for the victor, deserues a Murall Crowne. Whilst other men (put case) more able, haue looked on and pittied themselues, I haue giuen the onset, with courage enough if not too much, & viui peruenimus; but with what dextery is in you to iudge. Many obiections are made against me. First, that being a professed Scholler I should haue written in Latine. That indeed had bene easier for me by far, hauing the words made to my hands, the passages chalked out, and plenty of Authors to haue gleaned from, and a little Latine, such as it is to haue varied my discourse: but it had bin most ydle, my purpose being to better them who do not so well vnderstand that language. I should, saide another, haue made an Anatomy of my owne. Such Guls little know what it is to write an Anatomy; thirtie yea forty yeares practise (which are more then the daies of my life) in dissection, and a hundred bodies more or lesse, small and great euery yeare, hath bin thought little enough to make an Anatomist fit to teach this learned age; for which I dare bouldly say, no man amongst vs that knowes himselfe can esteeme himselfe sufficient, because wee want those meanes which other Countries afford their professors. Notwithstanding my counsell and end of right I require should be approued, my performance not so. The figures are no other then those of Vessalius, Plantinus, Platerus, Laurentius, Valuerdus, Bauhinus, and the rest; no other then those which were among our selues dedicated to three famous Princes, the last a Mayden-Queene. For my adding the History of the parts of Generation, I haue already giuen account, partly to his Maiesty, partly in my Prefaces to the fourth and fift bookes. My present worke is for the most part out of Bauhine for the History, Figures, and seuerall Authors quoted in his Margents. The Controuersies are most what out of Laurentius, with some additions, substractions and alterations as I thought fit and my wit would serue. The Method I haue altered throughout, transported the Tables as seemed best vnto me, reuised and made choise of the quotations in Bauhine, and interposed them in their owne places. I also added Prefaces to euery booke containing the argument and purport thereof: and in the subsequent discourse

The Praeface to the Chirurgians.

many passages partly out of my owne observations, partly as I met with them in approved Authors. The streame and current of Bauhines discourse because it is very hard, intricate, and full of long continued sentences, I haue broken off and parted as it might best be vnderstood, which was one thing that made the volume to swell. The words of Art most what I haue kept that you might not be vnacquainted with them, yet haue I also rendred them as well as I could into our language.

The first booke is almost wholly out of Laurentius sauing for some passages, so is the fift, and had not the bulke of the volume growne too great, and so too chargeable to the Printer, I intended beside these thirteene Bookes some other observations; the grounds whereof I had from that excellent and oculate Anatomist Petrus Pauus of Leyden, my Maister and moderator in Anatomy. Heere you haue the worke perfected; not onely as Bauhine hath it in three Venteres and the Ioynts, but also after those, the kinds of Flesh, Simple, musculous, with the exact story of the Muscles throughout the whole body, the flesh of the Bowels and the Glandules. In the next place, the Vessels, Veines, Arteries and sinewes, with their diuarcations and diuisions from their originals euen to the extreme parts. Then the Membranes, Ligaments, Gristles and Fibres. And lastly, that cragged and rockie treatise of the Bones. In all which I haue added the Natures and Definitions of euery particular and the explications of them: their differences and diuisions with their Vses and actions; all which are omitted by Bauhine in his Theater, but supplied by me, partly out of Laurentius, partly out of those Dictates I gathered from Petrus Pauus before named. Finally, betwixt the 7. booke which contained the history of the vpper Venter, that is, the Head, and the ninth of the Ioyntes, I haue interposed a Booke of the Senses, collected out of Bauhine, Laurentius, and Iulius Casserius Placentinus, who wrote very accurately of that subiect, many of whose disputations I haue also added. One thing I craue pardon for aboue all the rest, and that is Casserius his praeface before the Controuersies of the eight booke, which indeede was not done by me, and the matter it selfe, to say truth, I doe not so well like. Againe, although I reuised the Presse, or rather the sheets and proofes, as they call them, my selfe; yet being sometimes out of Towne about my practise, and often though in towne yet necessarily called away from attending the correction, many litterall faults haue escaped, especially in the Greeke, and some more then literall, yet few such as well stumble the Reader, and fewer, it will be, then could be imagined should escape a worke of such vncouth argument to the Compositors, and written besides in a Schollers running hand. Thus much I thought good to aduise you of, my kinde and Worshipfull Friends, and so to commend my labor to your good acceptance and your honest endeavors and studies in this and other parts of your Art to Gods blessing.

From my house in S. Annes Lane, this last of May, 1615.
By your Louing Friend HELKIAH CROOKE.



TO THE YOUNGER SORT of the Barber-CHIRVRGIANS.



Y Friends, The Printer hauing made his voyage and returne of the first Impression of the Anatomy, solicited me againe to reuise the Coppie for a second Edition, which I haue now finished as you see with paines and care that what escaped before might bee now amended. I confesse I hoped well at first that my labour would be acceptable vnto you, and I confesse as freely that my hope hath not beene frustrate: I haue therefore my reward, and that reward hath encouraged me to step one step farther for your behoofe, that is, to explicate the vse of some Chirurgicall Instruments which are vsfull in your Art. Not with intention to write a *practise of Chirurgery* (as the Printer in my absence this Summer hath vnadvisedly of his owne head entituled it) but onely that by this manuduction, you might bee led, to teach you to goe by your selues afterward. Beside, it is but a little that is done, and will serue to whet the appetite rather then to satisfie it: Neither indeede could it be much, partly because I had not much time to spare, or if I had, would the volume haue borne much more. *Pareus* pleased me best, as being not onely in my account but in common esteeme the best Chirurgian. The Instruments therefore are all his, and so is most of the discourse vpon them, sauing that now and then you shall finde his prolixitie contracted, his obscurity explained, and here and there a few things added. His Medicines I purposely set downe in Latine to acquaint you so to vnderstand them. Thus much shall suffice by way of advertisement: Fare you well.

From my Study in Colemanstreete
Octob. 30. 1630.

TO THE YOUNG SORT

I have been thinking of you very much lately, and wondering how you are getting on. I hope you are well and happy. I have been very busy lately, but I have managed to find some time to write to you. I have been thinking of you very much lately, and wondering how you are getting on. I hope you are well and happy. I have been very busy lately, but I have managed to find some time to write to you.

Yours truly,
John Smith

The Contents of the feuerall Bookes
contained in this Volume.

I. Booke.



Of the Excellency of Man, together with the Profite, Necessity, Antiquity and Method of Anatomy.

II. Booke.

Of the parts Inuesting and Conteyning the whole Bodie, and also the Lower Belly in particular.

III. Booke.

Of the parts belonging vnto Nutrition and nourishment.

IIII Booke.

Of the naturall parts belonging to Generation.

V. Booke.

Of the History of the Infant, most accurately described, according to the opinion of *Hippocrates*.

VI. Booke.

Of the Middle Region, called the Chest, containing the vitall parts.

VII. Booke.

Of the third & vppermost *Venter*, called the Head, wherein are described the Animall organs.

VIII. Booke.

Of the Senses and their Instruments, and also of the voyce.

XI. Booke.

A brieife description of all the Ioynts.

X. Booke.

Of Flesh, that is, of the Muscles, the Bowels, and the Glandules.

XI. Booke.

Of the vessels containing three parts, namely, Veines, Arteries, and Sinewes.

XII. Booke.

Containing foure parts, viz. Gristles, Ligaments, Membranes, and Fibres.

XIII. Booke

Of the Bones.

The Contents of the Jewell Booke

Containing the Jewell Booke



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of the worth of the Jewell Booke,
And the nature and use of it.

II. Booke. Of the four parts of Man, and
of the nature of the Jewell Booke, and
of the use of it.

III. Booke. Of the nature of the Jewell Booke,
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XIII. Booke. Of the nature of the Jewell Booke,
and of the use of it.

XIV. Booke. Of the nature of the Jewell Booke,
and of the use of it.

XV. Booke. Of the nature of the Jewell Booke,
and of the use of it.

Εἰς Ἰλχὺ Κρωκου ἀρχιῶν
 Ἀρατεμὶδ Σπολογητικόν.

Ἡελίῳ κατὰ κατὰ βδελύγματα κέρον
 Αἵματε δαλυτέρῳ ἱερῷ γράφε γραφή:
 Τύμνῳ Ἀδάμ, γύμνοντε βρέφῳ μὴ τεύρεται αἰδοῖ,
 Δεῖδε νόμῳ βρεφῶν γύμνα, νόμῳ βλέπειν
 Οὐδὲ πᾶσαν δαίμνι, εἰς πᾶσι περὶ γυῖν Εὐρυπύ
 Κρυπῆρ ἢ χαλκῆς ἀτραπον, ἡδε φῶς.
 Ἀμπλακίῳ δηλοῖς ἐλαφρῶς τῷ κλειδῷ ἐχόντι
 Δωμάτε δεσμοφόρῳ, σὶτε Γάλλω δὴ μὲν
 Δένδρον ἐπισήμνι μαγικῶς ἀποφύλατο τέχῃ,
 Ἀρεσῶντε πλόχῳ, Σατραπίωντε δόλῳ.
 Χρῆ τοι ταῦτα μαθεῖν, ζῶντι γὰρ κάρπον ἐλαμῶ,
 Πυκνὸν δὲ δάκρυον ἢ δ' ἀκροῦ, ἡδε φυλῶ.
 Οὐ πρῶτ' ὅτ' αἰμῶν ἀρδρα πένε, νύ τ' ὅτ' αἰσθῆρ
 Δασκῶ, ἡ εἴτα νόμῳ, λαοὶ δὲ δάσκει μὲν.
 Χαῖρε πᾶσι, νύ Ἑλλάς ἐφύε, Κρωκοιο πόνοισι,
 Παντοδᾶπντε κλέω εἰς Παρθένῳ εἶχει.
 Κόμψον ἐπ' ὅτ' ἐμῶν δὲ λῖλῳ, ἡ δὲ γυμνασία πολλῶν
 Οὐφαί ἐν παύροις, ἀν' ἡπάλῳ τε βίλῳ.
 Ἀναμῶ Πιμπλιάδων, ἐς αἰμίονα θυμὸν ἀναγε
 φείδεθ' Ἰππολύτῳ τείπλῳ βελέμνῳ Διῳ.

Sol.
 Sap. 14.
 Levit. 15, 24.
 20 18.

Mos.
 Levit. 15, 2, 3.
 24. 13.
 Math. 16. 19.
 Ioh. 20 3.

Invidia, Sub-
 jectio, De-
 tractio.

Judges 3. 22.
 Gene 32. 35.
 Gene. 2. 23.

Envy.
 Scorne.
 Detraction,

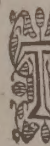
In tactusq, latum immundum speculatur * Aquilus,
 Femineamq, notant scrinia * cern * lucem.
 Nudus Adam, nudusq, puer non ora rubescit,
 Nuda nec impubi cernere mente nefas.
 Morbida non patitur, non lex * vada rubra Secantis,
 Natura ut lateat * nequitiaq, via.
 * Clauibus instructo pandas delicta lubenter,
 Et bona confidico, membraq, Celse tibi,
 Arbor notitia Magicas en extudit artes,
 Haresimq, plicas, imperijq, plagas.
 Hac quoq, nosse iuvat, vitag, excerpere fructus,
 Pestibus armatis pharmaca sine fugam.
 Non primus genitor secuit; iam cuspide primum
 Hinc animo dirimas deniq, membra dece.
 Plaudite parens, Argiva cluis, molimino Croci,
 Omniparos flores unicus hortus habet.
 Vocem aptam, methodum accliuom, sexcentaq, paucis
 Dogmata conspicias strictaq, tela virum.
 Pimpliadum soboles hinc ad potiora mouere,
 Hippolyto parcant flagra * trifulca Iouis.

TH'vntained Sun on * E G L O N s dung can stare,
 And Sacred writ doth * R A C H E L s Months declare:
 The Babe though nak'd, and * A D A M dreads no shame,
 To gaze with Babe-like minde, can breede no blame.
 Nor Leches lore, nor M o s e s Lawes can bide,
 Or sinnes, or Natures hidden parts to hide.
 To him that holds the keyes thou'lt shew thy sin.
 BRAC T A N thy Case, H I P P O C R A T E s thy skin:
 The Tree of Knowledge Magicke did deuise,
 And errors gin, and Florentizing guize;
 Yet fruit of Life they bring, which these reueale,
 That arnied poysons we may shun or heale:
 Nought needed A D A M, but we first must cut,
 Next know, last teach, how euery member's put.
 Ioy England, rich as Greece by C R O O K E s long toyle;
 All Flowers budding in thy blessed soyle.
 Fit words, smooth order, many mindes in short
 Be here compriz'd, and what their proofes import.
 Mount hence O Muses child to higher wonders,
 Nor feare H I P P O L I T V s * three forked thunders.

Ambrose Fisher.



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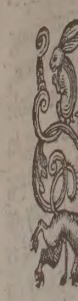
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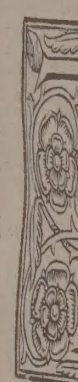
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OF THE EXCELLENCIE OF MAN.

Together $\S$ *Profite*, $\S$ *Antiquitie*, $\S$ of ANATOMIE.
with the $\S$ *Necessitie*, $\S$ *and Method* $\S$

As also of the *Authors*, *Subiect*, and *generall Precepts*
of the same.

THE FIRST BOOKE.

The Præface.



THE worth and excellencie of an Art, is greater or lesse, according to the dignitie or basenesse of the Obiect, whereabout it is conuersant. So in the *ἐγκυκλοπαιδεία*, that is, the Orbe or Circle of the Arts, *Logicke* is worthily esteemed the first in order, because the Obiect thereof is *Reason*; whereby (as by *Ariadnes* clew) we are directed through all the intricate Labyrinths and Mazes of Nature; and *Diuinitie* the last and most excellent, as being the end and consummation of all the rest, teaching vs how to liue blessedly both here and for euer: and therefore though all Arts be indeed originally from God, yet this is said more properly to be *ἀποθεῖ κατεργασμένη*, because it is immediately deliuered, and that by inspiration from Heauen. Betwixt these two, there are many Arts full of secret and obstruse notions, deepe mysteries and high contemplations, yet none, me thinks, that can stand in competition with this we haue in hand concerning the frame of Man. For to let passe the rest; if it shall be objected, That the infinite extent, the absolute and circular figure, the perpetuall and rapid motions of the Heauens, the glorious Bodies wherewith they are spangled, the sweet harmonie of their Spheares, the powerfull influence of euerie Starre (the least of which is said to be eightene times as bigge as the Earth) as they are in heighth and magnitude, so they are in dignitie farre aboue the nature of Man: If for the Earth it shall be said, that it is the rich Matter and Matrix, the great Mother and Nurse of all Creatures; the Spouse of Heauen, in whose onely bosome (as in their proper Center) all the influences of the heavenly Bodies doe concur and vnite themselves, lesse subiect to
B alteration

alteration then Heauen it selfe, if we beleue Astronomers; immouable and yet in perpetuall motion; by the continuall corruption and generation of things, alwayes consuming yet neuer diminished. If a Common-wealths-man shall preferre the Art of Policie, whereby not onely particular Men, but Cities, Kingdomes, Empires, yea and the whole World is kept in order which otherwise would run head-long to confusion; this being an Image of Gods gouernment and the verie Character of his administration in punishing Vice and rewarding Vertue: If, I say, any Man shall preferre the knowledge of any of these to the mysterie of the Humane Nature, I would haue him esteeme; that there is nothing either in Heauen or on Earth, or in the administration of them both, not only on Mans part, but which is more, on Gods also, that is not equalled, yea the Diuine historie giueth vs warrant to say, exceeded in the frame of Man. For, whereas in the Creation of the Heauens & the Earth, and the furnitures and armies of them both, the great Architect wrought them all by his thought, word and deed, all falling into one instant of time:

Genes. 1. 23.

When he was to make Man, he holds a Councell, *Come let vs make man according vnto our owne Image*; summoning thereunto, not onely himselfe and all his attributes, as his Power, his Wisedome, his Iustice, his Loue & Mercie, if not to cast in some part, yet to lend some influence of their Diuine Natures towards his creation; but also his Son and the blessed Spirit: as if Man were a kind of production of the whole Deitie, or as the Poet saith,

Virg. Eclog. 4.

As. 17. 27.
Rhemusam.

Magnum Iouis incrementum; which I am the rather bold to say, because the learned Apostle vsurpeth the verie words of another Poet to the selfe-same purpose, *αὐτὸν γὰρ καὶ γένος ἰσμεν*, we are also of his off-spring; not that I conceiue (as some blasphemously haue done) that he was made out of the verie Essence of God, but because the Image of the Diuine Nature, is most liuely imprinted in his Soule and in his Body, and in the substance and qualities of them both. For the Soule, it carieth a deepe stampe of Diuinitie in the simplicitie, inuisibilitie and immortalitie thereof: That it is incorporeall & diffusiue, quickning, sustaining, gouerning and moving the whole Body and euerie part thereof, euen as God supporteth and ruleth the whole world being by a diffusiue nature, or rather infinite omni-presence at all times, in euerie place: That as the Deitie is but one in Essence, yet distinct in Persons, according to the Relative qualities therein, which yet hath neither different matters, nor formes (as we say) but are all one and the same Essence; so the Soule of Man is but one, yet that one, consisting of three essentiall and distinct Faculties or Powers, intellectuall, sensitiue and vegetatiue; which yet make no difference in the substance thereof, that it should not be one and an entire Soule. Againe, in the intellectuall part or power, there are two essentiall Attributes resembling their Prototype or originall in God, to wit, Knowledge and Will. As for the qualities of the Soule, they are either internall, or externall. The internall carie the Image of the Creator, as *S^t Paul* interpreteth it, in heauenly Wisedome, Iustice and Sanctitie; the externall, in Maiestie, Dominion and Soueraigntie ouer the Creatures; both which, the Poet hath excellently put together, where he speaketh of Mans creation, after the rest of the Creatures.

Colos. 3. 10.

Ouids Metam.

*Sanctius his Animal, mentisq; capaxius altæ
Deerat adhuc, & quod dominari in cetera posset,
Natus homo est.*

A Creature holier then the rest, and better fram'd to hold
A Soule infused from aboue was wanting yet; So borne
At length was Man, the rest in bands of awefull power to fold.

Aulius.

The Body also, as far as it was possible, carieth the Image of God, not in figure, as *Aulius* and his followers, the *Anthropomorphites* haue sottishly dreamt (he being an infinite Ocean of Essence, transcendent and aboue all comprehension of nature or time: which himselfe expresseth to *Moses* in the future tense of the substantiue verbe, *Ero*; signifying thereby, the present and eternall subsistence of a subiect, without any prædicate as we say in Schooles) but because the admirable structure and accomplished perfection of the Body, carieth in it a representation of all the most glorious and perfect workes of God, as being an Epitome or compend of the whole Creation, by which he is rather signified then expressed. And hence it is, that Man is called a *Microcosme* or little world, as in the following discourse will more at large appeare; to which with this short preamble as a Preface of Honour, we referre the Reader.

CHAP. I.

The excellencie of Man is declared by his parts, namely, the Mind and the Body, and first what is the dignitie of the Soule.

IN the Inauguration or Coronation of a Prince, there is nothing more stately or magnificent, then to haue his stile rehearsed by Men of greatest Nobilitie, euerie one adding some-what thereto, till the whole number of his Seigniories and Honours are heaped vpon him: If therefore, we list to search what and how magnificent haue been the acclamations of all ages, we shall find in the Records of Antiquitie, that Man, in whom the sparkes of heavenly fire, and seeds of the Diuine Nature are (as appeareth both by the Maiestie imprinted in his face and by the frame of his Body, which was made vpright and looking toward Heauen) was of the wise and prudent Priests of the Egyptians, stiled a reuerend and admirable Creature. That thrice-worthy Mercurie calls him *A great Miracle, A Creature like the Creator, The Ambassador of the Gods.* Pythagoras, μέτρον ἀπάντων, *The measure of all things.* Plato δαίμα δαυμάτων, *The wonder of wonders.* Theophrastus, *The patterne of the whole Vniuerse,* ἀντίμωρον παρὰ δαίμονα. Aristotle, *A politike Creature framed for societie.* Symesius, *The Horizon of corporeall and incorporeall things.* Tully, *A diuine Creature, full of Reason and Iudgement.* Pliny, *The worlds Epitome and Natures Darling.* Finally, all Men with one consent, call him, μικρόκοσμον, or, *The little world.* For his Body is, as it were, a Magazine or Storehouse of all the vertues and efficacies of all Bodies, and in his Soule is the power and force of all liuing and sensible things. That ancient Zoroaster, hauing long admired the singular workmanship shining in the frame of Man, at length cryed out, Ὁ ἄνθρωπος, πληροτάτης τῆς φύσεως ἀγαθία. *O Man, the glorie of Nature, even in her chiefest ruffe and pride, and her master-peece, when she durst contend with Heauen it selfe.* Abdolus the Barbarian, being asked what he thought was the most admirable thing in Nature, is reported to haue answered, not barbarously, but wisely; *It is onely Man who farre surpasseth all admiration,* because being the Image and resemblance of the whole world, he can suddainly (Proteus-like) transforme himselfe into any particular thing. Fauorinus did acknowledge nothing great vpon Earth, but Man.

The Diuines call him *Omnem Creaturam, Euerie Creature*, because he is in power (in a manner) *All things*; not for matter and substance, as Empedocles would haue it, but *Analogically*, by participation or reception of the seuerall species or kinds of things. Others, call him, *The royall Temple or Image of God.* For as in Coyne the picture of Caesar, so in Man the Image of God is apparently discerned. Others, call him, *The end of all things* (which in Nature is the first cause) to whom all sublunarie created Bodies & Spirits are obedient, yet he himselfe subiect vnto none, vnlesse peraduenture one Man come vnder the Lee and subiection of another. The kingly Prophet David, full of heavenly inspiration, desciphereth the dignitie of Man on this manner; *Thou hast made him little lower then the Angels, thou hast crowned him with glorie and honor, and giuen him dominion ouer the workes of thy hands.*

These are excellent, that I may not say diuine commendations, which Man hath, partly from his Soule, the most excellent of all formes; partly from his Body, which is as it were the measure and exemplarie patterne of all corporeall things. The Soule indeed is so diuine, that rayning and mounting it selfe sometimes aboue all naturall formes, it comprehendeth by an admirable, absolutely-free and incompulsue power, all incorporeall things seuered and diuided from all matter and substance. This Soule, if it could be discerned with the eye, or but conceiued by the mind, how would it rauish vs and lead vs into an excessiue loue of it selfe? Onely this is created, not generated; and albeit (as the Philosophers speake) there be a subiect supponed in her production, yet it is not produced out of the power of that supponed matter, but rather absolueth and perfecteth the same.

This onely is indiuisible, for all other naturall formes receiue augmentation, diminution and diuision, together with their subiects; but the Soule of Man is *wholly in the whole, and wholly in euerie particular part.* This onely is immateriall, herein alone participating with the Matter, that it is capable of all species or kinds, even as the *First matter* admitteth all impressions and formes; and yet the manner of reception is not alike in them both. For that *First matter* receiueeth but particular and indiuiduall formes, and that without vnderstanding: In the Soule are imprinted the vniuersall formes of things, and it hath

Mans stile
or titles.

Mercurius

Trismeg.

Pythagoras

Plato.

Theophrastus

Aristoteles

Symesius

Tully.

Pliny.

Microcosmos

Why he is

called The

Little world.

Zoroaster.

Abdolus.

Fauorinus.

How Man is

Euery creature

Empedocles.

Psal. 8.

The signes of

Mans honor

referred part-

ly to his Soule

partly to his

Body

The excellen-

cy of the soule

The Soule

alone is conti-

nually created

It alone is

indiuisible.

Immateriall.

How the reception of formes differs in the first Matter, and in the Soule. The Soule is the place of the Species or formes.

Aristotle. Plato. The Soule is in the middle degree of all things. The nature of the Soule is Angelicall.

In the Soule appeareth the image of the Trinitie.

Symonides

Hippocrates

also vnderstanding to iudge of them. The *First matter* admitteth those particular formes materially, and withall obliterateth or blotteth out the contrarie forme whereof it was before possessed: The Soule of Man receiues and entertaines the generall and vniuersall notions of things, free from all contagion or touch of Matter, not abolishing the contrarie or diuers formes whereof before it was possessed. This alone is incorporeall, immortall, *ἀνάντητος* or immutable. This may be called the receptacle, promptuarie or Store-house of all the species or kinds of things.

Aristotle in his third Booke *De Anima*, calleth it, *After a manner all things, Because* (saith he) *in an organe of sense, the sensible species or images of things are blotted out and as it were drowned, but the Soule retaineth them.* The Platonists doe range it in the mid'st, as hauing God about it, and the *Intelligences* or Angels: below it, all bodyes and all qualities, that so it might be partaker of them both. According to Diuines, it approacheth verie neere to the nature of Angels, by reason of her vnderstanding or intellectuall power, of her originall, eternitie, image, apprehension and beatitude.

To conclude, there is in the Soule of Man something Metaphysicall, transcendent aboue Nature, vnkowne to the ancient Philosophers, who groped but in the darke, hauing their conceits enuoloped in a mystie or cloudy veile of ignorance; and is reuealed onely to Christians, to whom the light of the Gospel hath shined. For in it is a liuely resemblance of the ineffable Trinitie, represented by the three principall faculties, *Memorie, Vnderstanding and will.* But stay: Why should I presume to describe the Essence of the Soule, seeing it partaketh of so much Diuinitie? For of diuine things *Symonides* hath said well, We can onely say what they are not, not what they are. Why should I paine my selfe to open that shrine which Nature her selfe hath veyled and sealed vp from our senses, lest it should be prophaned by them? Hence it is, that *Hippocrates* calleth it *ἀόρατον ἀφανές*, *The in-aspectible or inuisible Nature*, which can no more be described by vs, then our eye is able to see it selfe. These things therefore belong to a higher contemplation, and require a more skilfull workeman to draw but the lines, or euen to shadow them out. Let vs content our selues to handle that which may be handled, or at least is subiect vnto some of our senses, and so proceed to the other part of Man, namely, the Body, which more truely and properly is the subiect of our discourse.

CHAP. II.

Of the dignitie and wonderfull frame of Mans body.



The excellencie of Mans body is set forth by foure things.

I. An vpright frame. Plato in *Cratylus*.

Of the vpright frame the efficient cause is two-fold.

AS the Soule of Man is of all sublunarie formes the most noble, so his Body, the House of the Soule, doth so farre excell, as it may well be called *μέτρον*, the measure & rule of all other Bodies. There be many things which set forth the excellencie of it, but these especially. First, The frame and composition which is vpright and mounting toward Heauen; the moderate temper, the equall and iust proportion of the parts; and lastly, their wonderfull consent and mutuall concord as long as they are in subiection to the Law and rule of Nature: For so long in them we may behold the liuely Image of all this whole Vniuerse as it were shadowed in a Glasse, or desciphered in a Table. And first for the Figure. Man onely is of an vpright frame and proportion, whereupon he is called of some *ἐρανοσκόπος*, vsually *ἀνθρώπος*, as it were *ἀνὰ θεῶν*, looking vpwards; although *Plato* in *Cratylus* is of opinion, that Man is called *ἀνθρώπος*, as it were *ἀνὰ θ' ἑντὶ α' ὀπῶν*, that is, contemplating those things which he seeth. The reason of this forme or figure, is meere Philosophicall, as depending vpon the Efficient, Materiall and Finall causes. The Efficient is two-fold, Primarie and Secundarie: The Primarie, is the Soule, which comming from without, and being infused into the Body from Heauen, whilst she is building a mansion fit for such functions and offices as she hath to performe, as mindfull of her owne Originall, listeth her building vp on high.

The Secundarie Efficient of Mans body, is Heat, wherewith Man aboue other Creatures aboundeth, especially the parts about his heart. The nature therefore of heat preuailling, forceth the increment or growth, vp from the middle part, according to his impetuous strength and nimble agilitie, that is, it striueth and driueth toward that part of the world, toward which heat is naturally moued, that is to say, vpward. For the Matter of Mans

Mans body, thing and to The Finall cause and proportion. Anaxagoras and the Stars all placed as preference-chances ner be exercised which is hum for contempt storie of the the better he the vapor th keep watch Distances an an vpright had an vpr given him Now if th should hau noble a diti ride, live in throw all groueling Wherefor this cause shion of fore the Creatur altogether the backe Figure. Man hat as being th either too Plants and middle of the cording to hath includ in their seu vnto Man- the heart of number of a solute Temp maged, as w extremes, been made a sublunarie at uerall specie knowledge tyed to app outward sent the ministry the Soule; it as might be hath his eff whence it is

Mans body, it is soft, plyable and temperate, ready to follow the Workeman in euerie thing and to euerie purpose; for Man is the moystest and most sanguine of all Creatures. The Finall cause of the frame of Mans body is manifold. First, Man had an vpright frame and proportion, that he might behold & meditate on heavenly things. And for this cause *Anaxagoras* being asked wherefore he was borne, he made answer, to behold the Heauens and the Starres. Secondly, that the functions and offices of the outward senses, which are all placed as it were a Guard in pension in the palace of the head, and in the view and presence-chamber of Reason, which is their Soueraigne, might in a more excellent manner be exercised and put in practise: For they were not ordained onely to auoid that which is hurtfull, and to follow and prosecute that which is profitable; but moreouer also for contemplation: and therefore they were to be placed in the highest contabulation or storie of the Body. And by this meanes, speech (which is the messenger of the mind) is the better heard from on high; the smell doth more commodiously receiue and entertain the vapor that ascendeth; the eyes being as it were spies or centinels day and night to keepe watch for vs, and being beside giuen vs that we should take view of those infinite Distances and glorious Bodyes in them which are ouer our heads, did therefore require an vpright frame and composition of the Body. Finally, to conclude this point, Man onely had an vpright frame of Body, because he alone amongst all Creatures had the Hand giuen him by God, an organ or instrument before all organs, and indeed, in steed of all: Now, if the figure of Man had been made with his face downeward, that diuine Creature should haue gone groueling vpon his hands, as well as vpon his feet, and those worthy and noble actions of his Hand, had been forfeited, or at least disparaged. For, who can write, ride, liue in a ciuill & sociable life, erect Altars vnto God, build Ships for war or traffick, throw all manner of Darts and practise other infinite sorts of excellent Arts; either groueling with his face downeward, or sprawling on his backe with his face vpward? Wherefore, onely Man had the frame of his Body erected vpward towards Heauen. For this cause also, onely Man amongst all other Creatures was framed according to the fashion of the whole vniuerse, because he hath his parts distinct, the vpper the neather, the fore the backe-parts, those on the right-hand and those on the left-hand; the rest of the Creatures either haue them not at all, or verie confused. The right-parts and the left are altogether alike sauing that the left are the weaker; but the fore-parts are verie vnlike the backe-parts: the lower in some sort carie a resemblance of the vpper: so much of the Figure.

Man hath likewise a moderate Temper, and is indeed the most temperate of all Bodies, as being the μέτρον, measure and rule of all others. The Bodyes of other Creatures, are either too Earthy, or too Watry: but to Mans, the temperature of all things liuing, both Plants and Creatures is referred as to the *Medium generis*, as we vse to say, that is, to the middle of the whole kind, so that they are said to be hot, cold, moyst and dry *πρὸς τὸ μέτρον*, that is, according to Reference; their temperature being compared with Mans. Againe, Man alone hath included in himselfe the temperature of all liuing things; all other Creatures are in their seuerall kinds (for the most part) of one and the same temper: but if you looke vnto Man-kind, you shall find some that haue the stomach of an Estrich; others that haue the heart of a Lyon: Some are of the temper of a Dog, many of a Hog, and an infinite number of as dull and blockish a temper as an Asse. This also declareth the *ὑπερβολή*, or absolute Temper of Mans body, that it is subiect to many diseases, and is equally endamaged, as well by one extreame, as by another; because it is equally distant from both extreames. There might indeed of the heavenly Matter (being the most noble) haue been made a Body most noble also; but it was of necessitie our Body should be made of sublunarie and elementarie matter, that it might be capable and apprehensue of the seuerall species and formes of things which moue the senses, because from them all our knowledge is deriued. For Man being borne to vnderstand, and he that vnderstandeth, tyed to apprehend those visions and fantasies which are objected either to the inward or outward sense; and there being no perception of any such vision or imagination, but by the ministry of the outward senses, which are the intelligencers betweene the Body and the Soule; it was necessarie that the Body of Man should be composed of such a matter as might be capable of these senses; but of all Senses the foundation is *touching*, which hath his essence and being in the temper and moderation of the foure first qualities: whence it is, that the foure first substances wherein those qualities doe reside, were

The materiall cause.

The finall cause threefold.

Anaxagoras

Man alone framed according to the fashion of the whole World

2

The excellencie of the body is likewise set forth in the temperature.

Man alone hath in himselfe the temperature of all liuing things.

Why the body of man was not made of an heavenly matter, but of an elementarie

necessarily to be the matter of the Body, and those are the foure Elements. And so much of the temperature of Mans body.

3
The admirable proportion of the parts

The circular and square figure appearing in Mans body.

Archimedes quadrature of the circle found in mans body.

4
Man containeth in himselfe all things in the whole world.

Three parts of the world.

The collation of Man with the world.

The elegant Analogie betwene the Sunne and Mans Heart.

Aristotle

Now the *συμμετρία* or due proportion, composition or correspondencie of the parts of Mans body, with respect each to other, and of them all to the whole, is admirable. This alone (for a patterne) doe all Work-men and Arts-masters set before them: to this, as to *Polycletus* rule, doe the Surueighers, Master-Carpenters and Masons, referre all their plots and proiects; they build Temples, Houses, Engines, Shipping, Forts, yea and the Arke of *Noah* (as it is recorded) was framed after the measure and proportion of Mans body; for, as the Body of a Man is in length 300 Minutes, in breadth 50, and in heighth 30; so the length of the Arke was 300 Cubits, the breadth 50 and the heighth 30. Moreover, in this proportion of his parts, you shall find both a circular figure, which is of all other the most perfect; and also a square, which in the rest of the Creatures you shall not obserue. For the nauell being placed in the middle of the whole Body, and as it were in the center; if you lay a Man vpon his backe, and as much as may be labour to spread both his hands and feet, and keeping one end of the compasse vnmoued and set vpon his nauell, doe turne about the other end, you shall come vnto both the thumb-toes of the feet and the middle fingers of the hands: and if in any part this proportion faile, you may imagine there is a defect in that part. Also, if you conceiue a measure betweene the feet spread abroad, and likewise betweene the hand and the foot on either side, you shall haue a perfect quadrat drawne & portrayed within that circle. And this is the true quadrature of the circle, not those imaginarie lines whereof *Archimedes* wrot, and which haue troubled the heads of all our Mathematicians for many ages, when as euery one might haue found it in himselfe.

These be excellent things which we haue obserued, touching the figure and frame of Mans body, the temperature thereof, and the proportion of the parts; but this last exceedeth all admiration, that in it selfe alone, it should containe all whatsoeuer this whole world in his large & spacious bosome doth comprehend; so as it may worthily be called a Little world, and the paterne and epitome of the whole vniuerse. The ancient Magicians (for so naturall Philosophers were of old termed) as also the great wise Priests of the *Egyptians*, did make of this whole vniuerse, three parts: The one, Vppermost or superior, which they termed the Intellectuall and Angelicall part, the seat of the *Intelligentie* (so they called the Spirits, which by tradition from the *Hebrews*, they vnderstood were in the Heauens) by whose direction and command, the inferiour or lower world is guided and gouerned: another Middle, which they termed the heavenly part, in the midst whereof the Sunne ruleth, as the Leader and moderator of the rest of the Starrs: the third, Sublunarie or Elementarie, which is admirably & abundantly fertile, in procreating, increasing and nourishing of Creatures and Plants. The images and resemblances of which three parts, who seeth not plainly expressed and as it were portrayed out with a curious penfill in the Body of Man? The head, the castle and tower of the Soule, the seat of Reason, the mansion-house of Wisdome, the treasurie of Memorie, Iudgment and discourse, wherein Mankind is most like to the Angels or Intelligencies, obtaining the loftiest and most eminent place in the Body; doth it not elegantly resemble that supreme and Angelicall part of the world? The Middle and Coelestiall part is in the brest or middle Venter most exactly and euen to the life expressed. For as in that coelestiall part the Sunne is predominant, by whose motion, beames and light all things haue their brightnesse, luster & beauty; so in the midst of the chest the heart resideth, whose likenesse and proportion with the Sunne is such and so great, as the ancient Writers haue been bold to call the Sunne *The Heart of the world*, and the Heart *The Sunne of Mans body*. For euen as by the perpetuall and continuall motion of the Sunne, and by the quickning and lively heat thereof, all things are cheered and made to flourish; the Earth is decked and adorned yea crowned with Flowers, brings forth great varietie of Fruits, and yeelds out of her bosome innumerable kinds of Hearbs; the Shrubs thrust forth their buds or iems and are clothed with greene leaues in token of iollitie; all Creatures are pricked forward with the goads and prouocations of Lust and so rushing into Venereall embracements, do store and replenish with a large and abundant encrease, both Cities, Land and Seas; (for which cause, *Aristotle* calleth this prosperous, refreshing and comfortable Starre *γεννητικὴν*, as being the procreator of all things) and on the contrarie, the same Starre or Sunne being departed far from our Coasts, the Earth begins to be horrid and looke deformed, the Shrubs are robbed and dispoyled of their leaues, berries and verdure; and a great part of those things which the

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fertilitie of Nature had brought forth, is weakned and wasted : so in like manner, by the perpetuall motion of the Heart & by the vitall heat thereof, this Little world is refreshed, preferred and kept in vigor and good life ; neither can any thing therein be either fruitfull or fit and disposed to bring forth, vnlesse that mightie and puissant power of the Heart doe afford and yeeld an effectuall power of Fecunditie. The Vitall facultie floweth from the Heart as from the Fountaine, the coelestiall facultie from Heauen. This later, is said to be the preseruer of all inferior things : the former kindleth, nourisheth and refresheth the naturall heat of euerie part. The Heauen workes vpon the inferior world by his motion and light ; the Heart by his continuall motion & æthereall spirit, as it were a bright light, cleareth and beautifieth all the parts of the Body. The motion & light are in the superior Bodyes the instruments of the Intelligencies and of the Heauens ; of the Intelligencies as of the first mouers vnmoued, of the Heauens as of the first mouer moued. The Vitall spirits and pulsation or beating of the Heart are instruments of the Soule and of the Heart : of the Soule as of a mouer not moued ; of the Heart as of a mouer moued by the Soule.

The excellent
similitude of
the vitall and
coelestiall
faculties.

Now further, who seeth not the sublunarie part of the world expressed in the inferiour venter or lower belly ? For in it are contained the parts that are ordained for nourishment and procreation ; so as we need not make any doubt to profess and affirme, that all things are found in the Body of Man, which this vniuersall world doth embrace & comprehend. Wilt thou see in this *Microcosme* or little world the wandring Planets ? The moyst and watry power of the Moone is resembled by the streaming marrow and pith of the backe and braine. The power of *Venus* is proportioned in the generative parts. To *Mercurie* so variable and withall so ingenuous, the instruments of eloquence and sweet deliuerie are answerable. Of the Sunne and the Heart, the admirable proportion and agreement, we haue already declared. To the beneuolent and beneficall Starre *Iupiter*, the liuer of Man, the well-spring of most sweet and gratefull humors is fitly compared. The fire and furie of *Mars*, the little bladder of the gaule gathers into it selfe. The cold and harmfull Starre *Saturne*, that loose and flaggie flesh of the spleene, being the receptacle of melancholike humours, doth liuely resemble. And thus in like numbers and equall proportion, both Arithmetically and Geometrically, doe these Coelestiall particles (as they are termed) of either world, the greater of Heauen and the lesser of Man, answer one another. The twelue signes of the Zodiacke, by the Astrologers elegantly depicted in the Body of a Man, I passe over with silence : for these are things ancient and commonly knowne, as being fung in the corners of our Streets : we choose rather to meditate of more sublime and profound matters and to bend the eye of our mind at a higher marke. The *Peripatetikes* doe diuide the world into Bodyes simple and mixt ; simple they make five, the Heauen and the foure Elements ; of the mixt Bodyes, they will haue some to be imperfect, which they call Meteors, and those Fierie, Aerie, Watry, Earthy : other some perfect, as those things that haue life. All which, how and after what manner they be in Man, because it is an excellent and beautifull speculation, I pray you marke and obserue with me diligently. Of this Little world, the simple Bodyes are five, the spirits & the foure humors. The Spirit is the quintessence or fifth essence, æthereall, in proportion (as saith the Philosopher) answering to the Element of the Starres ; the foure humors are called the foure sensible Elements of the Body. Choler in temper the most hot and raging resembles fire. Blood hot and moyst resembles the aire. Flegme cold and moyst resembles the water. Melancholy cold and dry is fitly compared vnto earth. Behold also the wonderfull Analogie of the Meteors of this Little world. The terrible lightning fierie flashes and impressions, are shewed in the bloody suffusions of our eyes when we are in a heat and furie, as also by those *ελαμψεις* or darting beames which we throw from the same. The rumbling of the guts, their croaking murmurs, the rapping escapes and the hudled and redoubled belchings of the stomach, doe represent the fashion and manner of all kinds of thunders. The violent and gathering rage of blustering winds, tempestuous stormes and gusts, are not onely exhibited, but also fore-shewed by exhaled crudities and by the hissing, singing and ringing noyses of the eares. The humor and moistnesse that falls like a current or streame into the emptie spaces of the throat, the throtle and the chest, resembleth raine and showres. Thicke and concocted flegme, that comes vp round and roundly when we cough, carries the likenesse of haile-stones ; teares doe represent the dew : shaking, shrinking, trembling and throbbing motions, resemble the earth-quakes. There are also found

The wandring
planets
in the Little
world.

The comparison
of both
worlds according
vnto the
doctrin of the
Peripatetikes.

The simple
bodyes of the
Microcosme.

The Meteorologic
of the
Little world.

in our Bodyes, mines and quarries, out of which mettals and stones are digged, not to build, but to pull downe the House; so the stones of the kidneys and bladder doe carie a resemblance of Mines and Minerals.

Perfect
exaltation.

This is the Meteorologie of this Litle world, this is the demonstration of those things therein that are imperfectly mixed. And if you require in Man an example of a Body perfectly mixed, behold and consider the whole Body; in which, there is that concord and agreement of the foure disagreeing qualities, and so iust and equall a mixture of the Elements, as that it is the verie middle & meane amongst all liuing and animated things. This Litle world therefore, which we call Man, is a great miracle, and his frame and composition is more to be admired and wondred at, then the workmanship of the whole Vniuerse. For, it is a farre easier thing to depaint out many things in a large and spacious Table, such as is the world; then to comprehend all things in one so litle and narrow, as is the compasse of Mans body.

• CHAP. III.

EPICVRVS, MOMVS, and other the malicious and false detractors from Nature are censured, and the excellencie of Man is demonstrated by his nakednesse.



Et that beastly *Epicure's* mouth be now sealed vp in dumbe silence, who was not ashamed to affirme, that the Bodyes of Men were made by chance and fortune, out of a turbulent concourse (forsooth) of a number of Atomies or Motes, such as we see in the Sunne. Let *Momus* be hissed and exploded, but first mark't with a blacke brand of ignorance and infamie, who presumptuously blamed in the frame of Mans body many things, as lame, mamed and vnperfect. Let all the whole rabble of doting Philosophers, be banished out of the Schoole of Nature, who cease not to wrong and traduce her, for casting forth Man naked and vnarmed on the bare ground vpon his Birth-day, to begin the world with crying and lamentation. For to begin with the *Epicure*: Those things which come by chance (O *Epicure*) happen but sildome, and of such things neither any certaine, nor any prosperous euent can constantly be expected or hoped for: but if thou doest heedfully obserue 1000 Men, thou shalt find all their Bodyes made and framed with equall skill and vnmachable art; the same structure of Bones, Cartelages, ligaments, Sinewes, Veines, Arteries and Entrals; the same context and composition, figure or fashion, number and scituation: The right-side like vnto the left; and all the Body within one and the same circle and compasse equally poysed; so that nothing in the frame of Mans body doth thrust it selfe in by chance, nothing there is that doth not exhibite and represent vnto vs the Maiestie of the highest and most heauenly Wisedome.

The error of
the *Epicures*
conuincied.

Galen.

Galen, to conuince the error of this beastly *Epicure*, said, He would giue him an hundred yeere to conceiue an alteration or change of the scituation, figure or composition of any one part, and he did not doubt, but it would come to passe in the end, that he would be forced to confesse, that the same could by no meanes haue been made after any more perfect manner. I will speake some-what more boldly; If all the Angels should haue spent a thousand yeeres in the framing and making of Man, they could not haue cast him in so curious a mold; or made him like to that he is, much lesse could they haue set him forth in any better manner. Let the *Epicure* therefore be packing with this false fiction and feigned inuention of his owne addle braine. As for *Momus*, he is to be scorned for his dotage and simplicitie, who wished Mens bodyes had been made full of windowes, that the affections of the mind might haue appeared. Why *Momus*? Doe not all the passions of the mind appeare plainly characterized in the face & in the eyes; so that he which runs may read them? The eyes are the discouersers of the mind, as the countenance is the image of the same; by the eyes as by a window, you may looke euen into the secret corners of the Soule: So that it is well said of *Alexander*, ὁφθαλμοὶ τῆς ψυχῆς πάλσιπρον εἶναι, that the eyes are the mirror or looking-glasse of the Soule. The eyes wonder at a thing, they loue it, they desire it; they are the bewrayers of loue, anger, rage, mercie, reuenge; In a word; The eyes are fitted and composed to all the affections of the mind, expressing the verie image thereof in such a manner, as they may seeme to be euen another Soule; and therefore

The slander
of *Momus*
condemned.

Alexander.

when

when we kisse the eyes, we seeme to reach and diue euen to the verie Soule. And for the face, how many signes are there in it, and those verie manifest and apparent, of a sorrowing, fearing, couetous, wrathfull and pleasant mind? In the whole countenance, audaciousnesse, shamefastnesse and maiestie are euident and conspicuous. For in the eye-browes dwelleth pride, in the cheekes shamefastnesse, in the chin maiestie: All these are bred in the heart, but here they haue their seat and residence, hither they betake themselves, hereupon they depend.

Their insolencie is also to be restrayned, who call Nature a cruell step-mother, because she casts forth Man into the world altogether naked and vnarmed both in Soule & Body; and therefore hold him to be of all Creatures the most imperfect. And of the nakednesse of the Soule, thus they discourse. Other Creatures (say they) doe perceiue and vnderstand their owne nature; some betake themselves to the swiftnesse of their feet, some trust to the loftinesse of their flight, some to swim in the waters; Man knoweth nothing, neither how to speake, nor how to goe, nor how to feed: And in a word, that Creature which is borne to rule and gouerne all the rest, is enclined by Nature to nothing else but mourning and lamentation, beginning his life with punishment, and that onely for one fault, to wit, because he is borne. Moreouer, many Creatures goe beyond Man (say they) in perfection of the senses. For in the piercing sight of the eyes, the Eagle; in the quicknesse of smelling and sent, the Dog; in hearing the Foxe and Mole are quicker then we; in tasting, the Hen is sharper; in touching the Spider is more exquisite then we: And so the Soule of Man is more imperfect then that of other Creatures. Let vs heare also the complaints they make of his Body. Nature hath giuen other Creatures diuers couerings, shels, rinds, haire, bristles, feathers, scales, fleeces, hornes, teeth and nailes, whereby they are able both to defend themselves and offend others; onely Man she hath prostituted in his verie natiuitie, altogether vnarmed, naked and vnable to helpe himselfe. They complaine also, that in bignesse of Body we are not equall vnto the Elephants, in swiftnesse to the Harts, in lightnesse to the Birds, in strength and might vnto Bulls, in length of life to the Crowes: That the Beasts of prey haue a skin more solide; the Dooe more slicke and comely, the Beare a skin thicker then ours; and to shut vp all, they say no Creature hath a life more frayle and brittle then Man.

But how ill they reason and how vniust and vnequall valuers they be of diuine blessings, let all Men heare and vnderstand. Surely God euen for this purpose created Man naked, that he might be the Prince and Ruler of all those things that are comprehended within, or subiect to the Law and dominion of Nature. For as the organs or instruments of the senses are void of all strange and externall qualities that they may receiue and entertaine the seuerall species and shapes of all other things; no particular colour there is in the cristalline humor of the eyes, no naturall and inbred sound in the eare, the tongue not falsified with any tast or sauour, the nosethrills haue no proper or particular smell, touching is not possessed of any extreame; right so it was not meet that the mind or soule of Man, which as the Philosopher teacheth, *was in power in a manner all things*, should be preoccupied or taken vp with any particular Art or indowment. The Body also behooued to be naked and vnarmed, that such a Creature as was to gouerne all the rest, should not be tyed onely to one kind of Armor or Weapon: And how incommodious and vnseemly had it been for Man being made for contemplation, alwayes to haue born Armes? Now, he can at his owne will and pleasure, both girt himselfe in all manner of Armor and again presently lay it aside: and therefore, Man is naked, and so it best behooued him to be. But yet God hath not left him destitute euen in this kind, hauing armed him with three seuerall muniments, which he hath denyed to other liuing Creatures; Reason to inuent, Speech to call for assistance, and Hands to bring his will to act and perfection. Reason, is the hand of the Vnderstanding, Speech the hand of Reason, and the Hand it selfe, is the hand of Speech. The hand executeth those things which are commanded, our commandments are subiect and obedient to Reason, and Reason it selfe is the power, force and efficacie of the Vnderstanding. So that in recompence of the nakednesse of the Soule, he hath two helps giuen him, Reason, which is an Art before all Arts; and Speech, the Ambassador or Interpreter of the mind. For the nakednesse of the Body, he hath the Hand, the great Organ before all Organs, and the Instrument of all Instruments. By the power of Reason and of the Hand, albeit Man be borne weake and naked, yet is he secured from all dumbe Creatures; whereas all Creatures whatsoever they be, that are borne and brought

Primarie.
Secondarie.
How vniustly
Nature is cal-
led a sowre
step-dame
to Man.
The Soule of
Man naked.

The Body of
Man naked.

An elegane
demonstrati-
on why the
Body is naked.

Aristotle.
Why the
Body is naked.

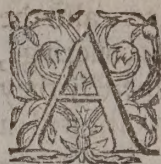
God hath
armed Man
with three
defences.

How behoof-
full Reason
and the Hand
is to Man, and
what he per-
forms by
them.

brought forth more firme, yea and more fierce too; howsoever they are able stoutly to endure the force and violence of the Heauens, yet they cannot be secure & free from Man. See now and behold, whatsoeuer thou art, that art a traducer and slanderous detractor from Nature; how bounteous and liberall bequests and legacies this Mother of ours hath bestowed vpon vs; how farre more puissant Creatures, by the ayd of Reason and of our Hands, we haue subdued and brought vnder the yoke; how farre swifter we haue overtaken; neither is there any mortall thing that is not subiected vnder our will and obedience. So then we see, that Reason doth more auaille Man, then any naturall gift doth the dumbe Creature; the volubilitie and readinesse of the tongue and speech, more then the lightnesse and nimble vse of the wings and feathers; the industry of the hands, more then the impetuous force and violence of Bulles, or the teeth or hooues of wild and rauinous Beasts, because they cannot redeeme or free themselves from being oppressed by vs, or acquit themselves from the foueraigntie of our authoritie.

CHAP. IIII.

What the Body of Man differeth from other Creatures, and what it hath proper and peculiar in the composition and frame thereof.



ND now, lest those that are skilfull and learned, should want any thing in our discourse that belongeth to the dignitie of Man, and his admirable and wonderfull frame and composition; let vs proceed vnto such other things, as the diuine Wisedome, the Mother and Gouvernor of all things hath vouchsafed onely to Man, and see in what & how much the Body of Man differeth from the rest of the Creatures. As in Man and other Creatures there is the same manner of life and nourishment, so the frame and structure of the vitall and naturall Organs or Instruments is not vnlike in them both; but for the Senses and power of motion, wherein the Nature of the Animalitie (you must giue leaue to a Philosopher to vse his owne termes) or liuelyhood consisteth, forasmuch as in Man they doe attend vpon, and serue a more noble Forme, and are prepared to more diuine vses, then for the auoyding of euill, and such other obiects of the appetite; it was therefore requisite, that they should haue Organs framed and made with more curious and exquisite workmanship. There are therefore in Man, ouer and besides those things that are already handled, namely, his vp-right Figure and his Hands, which no other Creatures haue; there are, I say, many things in the structure and composition of the animall Organs, proper & peculiar to Man, which doe yet more demonstratiuely proue, yea and expresse also the dignitie of his Body. To run through all, from the Head to the Feet. First, of all liuing Creatures, onely Man hath a Head made into a round and circular forme, as it were turned on a wheele, both that it might be the more capable to receiue a greater quantitie of Braines and lesse apt to be ouertaken with danger either from without or within; as also, for the more ease in mouing and turning about; and lastly, because it was to be the Mansion-house of Reason, that is, the Soule. Now we know, that the Soule was not Traduced but Infused into vs from Heaven, which euen to our sense is round and circular; Seeing then her heavenly habitation is round before she is infused, it was likewise requisite, that her Mansion here below should be orbicular also; yet is the Head of Man not exquisitely round as a Bowle is, but after a sort some-what long also; ryfing vp in the two crownes and on the sides becometh depressed and flatted. Man of all liuing Creatures, hath for his bignesse, a Braine most large and ample, and also verie moyst and watry, the better to performe the varietie of the Animall functions and offices; for the Soule doth not execute hir offices without the helpe of the Spirits: the matter and the substance of the Spirits is Blood, now plentie of Blood is not contained, nor can be concluded within a little and small Body or compass.

The Face is sayd also to be proper vnto Man alone, whereupon the *Greekes* call it *πρόσωπον*, by a name deriued from the thing it selfe, because *πρόσωπον*, it seeth and is seene a farre off; to other Creatures *Nature* hath giuen onely a mouth or a beake: but in the Face of Man, courage, shamefastnesse and maiestie haue their aboad, and therefore Man alone is bashfull & shamefast. At the beholding of this Face, all Creatures are affrighted, because

What there is
in Mans Body
proper and
peculiar to
Man.

I.
A round head

2.
A large Brain.

3.
Man onely
hath a face.

because in it there shine forth more beames of the diuine Nature, then in all the Body besides. This one thing is admirable therein, that whereas in our Face and countenance there are but ten particles, or not many more, yet you shall not find any two among many thousands of Men, that have their countenance in all parts alike, but there is some diuersitie, both in the lines and in the proportion.

Man alone hath his Eyes enamelled with diuers colours, and that in great varietie; whereas other Creatures (the Horse excepted) are in their kinds alwayes alike; so shall you find Oxen to haue all blacke eyes, Sheepe watry, other Creatures red. The eyes of Man are distant one from the other but a very little space, in respect of our proportion of magnitude with other Creatures, that so the Spirits might be the more nimble and more speedily transmitted from one eye to another. Man alone of all Creatures (saith *Pliny*) hath his eyes vitiated and corrupted, yea and sometimes one or both wanting; whereupon came the names or nick-names rather of *Strabo*, one that is squint-eyed or goggle-eyed, and *Patus* for one that hath rouling eyes or squinted vpperward. The haire of the eye-lids are in foure-footed Beasts onely on the vpper lid, in Birds on the neather; Man onely (the Estrich excepted) hath haire both on the vpper and neather lid.

The Nose of a Man is higher and standeth further out then the rest of his Face for decencie and comlinesse; in other Creatures it is not so, but is flatted with the Skull.

Onely in Man the Eares are fixed and immouable, and placed on either side in a right line with the eyes; onely in Man (except it be Apes, which are neere to the proportion of Mans body) are those bones we call *Clauicula* or Cannell bones, which serue to establish the Arme, that in the diuers and sudden motions thereof, it might not be dislocated.

There is no Creature but Man hath Dugges in the fore-part of his Body, the Elephants haue indeed two Dugges or pappes, but not in their Breast.

Those parts which in Man are foremost, that is, on the forepart, as the Breast, the Belly, the Wezon, &c. foure-footed Beasts haue them below next vnto the ground, and those that Man hath on the hinder-part, as the Backe, the Loynes and the Buttocks, Beasts haue them in their vpper parts.

Man of all Creatures is couered with the fewest haire, ylesse it be in his head, which as it is the moystest part of his Body, so also it is the most replenished with haire. Againe in Creatures that are couered with haire, those parts are most hairie that bend downward toward the ground, the rest are either smooth without haire, or not so full of them. On the contrarie, Man is most hairie on the fore-part, because haire was made for a couering; the prone or bending parts of Beasts, stand in need to be couered, yet the foreparts are indeed more noble, but they are cherished & in some sort couered by the bowing and bending of the Body: But in Man by reason of his loftie and vpright frame and composition of Body, the fore-part is alike exposed to outward iniurie as the hinder-part, and therefore it was meet the more noble part should be couered and (as it were) defended with haire. Onely Man hath haire growing vnder the Arme-holes and about the Priuy-members. Man alone growes hoary-haired and bald-headed.

The Legges or Haunches of all foure-footed Beasts, are abundantly full of bones and sinewes, but very scantie of flesh; on the contrarie, Man hath almost no part of his Body more fleshy then his Hipples, Legges and Thighes.

Foure-footed Beasts doe bow both their fore-legges and their hinder-legges contrarie to Man, for he bowes his Armes backe-ward and his Legges fore-ward.

Man, when he is come to his full growth hath his vpper-part lesser then his neather-part; but before he be growne, his vpper-part is the greater; so is it not with the rest of the Creatures; and therefore his manner of going is not at all times alike, but at first in his infancie he creepes on all foure, afterwards by little and little he rayseth vp himselfe, and at length goes vpon his two Feet.

In other Creatures there is no difference of the bones, but they do all appeare perfect, euen from their beginning; but in Children the fore-part of the Head is soft and tender, and long before it be hardned. And whereas all other Creatures come toothed into the World, Man begins not to haue teeth till the seuenth moneth after his birth.

Furthermore, of all Creatures (excepting Birds) that liue vpon the Land, Man alone is two footed, which moued *Plato* to define him, *Animal bipes implume*; which definition *Diogenes* worthily derided, when he flung a Cocke whose feathers he had pluckt off, into the Schoole, and cryed out, *Behold Platons Man*.

Onely

4
Eyes of diuers
colours.

5
The distance
of the eyes.

6
The depriua-
tion of the
eyes.
Pliny
lib. 11. cap. 37

7
Haire on
both sides the
eyes.

8
A nose stan-
ding out.

9
Eares im-
mouable.
Cannell
bones.

10
Dugges.

11
The diuersitie
of situation
of the parts.

12
Fewest haire.

13
A difference
in those parts
that are coue-
red with haire

14
Haire vnder
the arm-holes

15
Man alone
hoary-haired.

16
Hipples, legges
and thighes
full of flesh.

17
The manner
of bowing of
the parts vn-
like to other
creatures.

18
The differ-
ence of the
Bones.

19
Man alone
two-footed.
Plato derided
by *Diogenes*

20
Man alone
goeth vp right.

21
Man alone
sitteth.

22
Man alone
hath a smooth
and slick skin

Aristotle.

Onely Man by the straitnesse of his Legges goes exactly vp right,
Onely Man vseth to sit, both because he cannot stand long, as the bruit Beasts may, which haue foure feet, and besides doe lye vsually to rest themselues prostrate vpon the ground, ; for that two feet cannot long beare the weight of the whole Body : as also because sitting is necessarie for more noble and excellent vses, to wit, for the practising and exercising of Arts and for contemplation.

Onely Man hath a Skin polished, smooth, cleare and verie temperate (other Creatures haue either a shelly or scaly Skin, or altogether hairie or else too soft) because Touching is the ground and foundation of all the Senses; and therefore the more simple and pure the Touching is, the cleerer also and the purer is the Sense, and the Phantasmes or imaginations the more subtile : by meanes whereof, the operation of the Soule, is so much the more loftie and profound. And for this cause, *Aristotle* in his second Booke *De Anima*, is of opinion, that the strength and vigor of the wit and vnderstanding, are to be iudged of by the coursenesse or finenesse of the Touch.

CHAP. V.

How profitable and behouefull Anatomie is to the knowledge of Mans selfe.

He that
knowes him-
selfe, knowes
all things.

Plato in
Alcibiade.
How profit-
able it is to
know our
selues.
Demonax.
Socrates.

Thales.

Anatomie the
most sure guid
to the know-
ledge of our
selues.

Democritus.

Anatomie
teaches how
to order the
state of the
mind.

Seeing then that Man is a Little world, and containes in himselfe the Seeds of all those things which are contained in the most spacious and ample bosome of this whole vniuerse, Starres, Meteors, Mettals, Minerals, Vegetables, Animals & Spirits; whosoever doth well know himselfe, knoweth all things, seeing in himselfe he hath the resemblance and representation of all things. First, he shall know God, because he is fashioned and framed according to his Image, by reason whereof, he is called among the Diuines, *The royall and imperiall Temple of God*; he shall know also the Angels, because he hath vnderstanding as they haue; he shall know the bruit Beasts, because he hath the faculties of sense and appetite common with them; he groweth as the Plants doe, he hath being & existence as stones haue, and in a word, he is the rule and square of all Bodyes.

Wisely therefore did the Oracle of *Apollo*, incite and stirre vp euerie Man to the knowledge of himselfe, as *Plato* hath it in *Alcibiade*. This by the Iudgement and consent of all Men, is true and sound Philosophy. For *Demonax* being asked, *When he began to professe Philosophy*, made answer, *When I began to know my selfe*. *Socrates* held it the next point to furie and madnesse, to enquire into high matters, and to search into strange and vncouth busineses, and be ignorant in the meane while of those things that be in our selues. This preposterous skill was once verie merrily and wittily by an old Wife cast in the teeth of *Thales* the Philosopher of *Miletum*; who as he inconsiderately cast vp his eyes to behold the Heauens, fell into a Pit; the old wife cryed out, *Thou Foole, thou pryest into matters that are aboue thee, and art ignorant of those things that are below thee, nay even within thee*. Surely it was a worthy speech, and not beseeming an old Beldame but a Philosopher. But this same knowledge of a Mans selfe, as it is a very glorious thing, so it is also very hard & difficult. And yet by the dissection of the Body and by Anatomie, we shall easily attaine vnto this knowledge. For seeing the Soule of Man being cast into this prison of the Body, cannot discharge her offices & functions without a corporeall Organ or Instrument of the Body; whosoever will attain vnto the knowledge of the Soule, it is necessarie that he know the frame and composition of the Body. After this manner, *Democritus* of *Abdera*, that he might find out the seat of Anger and Melancholy, cut in peeces the Bodyes of Beasts, and when he was taxed of the Citizens for madnesse in so doing, he was by the censure and determination of *Hippocrates*, adiudged to be verie wise and prudent.

Go too then, Is not he sayd to know himselfe, who can tell how to temper and order the state and condition of his mind, how to appease those ciuill tumults within himselfe, by the stormes and waues whereof he is pittifully tossed, and how to suppress and appease those varieties of passions wherewith as it were with so many Furies he is vexed and tormented? But all this Anatomie doth very plainly teach vs. For he that seeth & obserueth the whole Body, which by the structure and putting together of sundry parts of diuers forts and kinds, is (as it were) manifold and full of varietie, to be made one by the conti-

nuation

uation and ioyning of those parts; he that considereth the admirable sympathy of the parts, their mutuall consent and agreement, their common offices or officiall administrations one for the helpe of another, how they make not any couetous reseruation to themselves, but doe freely communicate each with other; such a Man no doubt will so moderate and order the conditions and affections of his mind, as all things shall accord & ioyn in a mutuall agreement, and the inferiors shall obey the superiors, the passions obey the rule of right reason. He that shall diligently weigh and consider the vse of euerie part, the fashion, scituation and admirable workmanship of them all, as also, the Organs and Instruments of the outward Senses, he shall easily perceiue how and after what manner he is to make vse of euerie part; then which thing, what can be more excellent? What more profitable?

Thou hast an vpright frame and posture of Body, that remembring thy begining, thou shouldst not like the bruit Beasts growell vpon the ground, or dote vpon earthly things, but lift vp thy selfe towards Heauen, and say with the Diuines, *our conuersation is in heauen*. Thy eyes are set in a high place, that thou mightest take notice, they are giuen thee to be aduanced to the contemplation of heavenly things.

Two Eares and those wide open, hath Nature ordained thee; to teach thee that thou must heare, and by hearing, learne twice as much as thou must speake. Nature hath giuen thee but one tongue, tyed with ten Muscles, and reyned with a verie strong ligament, besides, as it were with a Bridle, shut vp and enclosed within the mouth and teeth, as it were within a grate or lattice, that the mind might first discerne and iudge of a thing before it vtter it, and that our words might first passe by the file, before they passe by the tongue. If you looke into the seats and residence of the faculties of the mind, you shall find the Rationall facultie in the highest place, namely, in the Braine, compassed in on euerie side with a Scull; the facultie of Anger, in the Heart; the facultie of Lust or desire, in the Liuer: and therefore we may gather these lower and inferiour faculties, must be seruiceable and obedient to the higher, as to the Queene and Prince of them all. And if both Princes and Peasants would weigh and consider the mutuall offices betweene the principall & the ignoble parts, Princes might vnderstand how to rule, and Peasants how to obey. Princes may learne of the Braine how to make Lawes to gouerne their People; of the Heart, how to preferue the life, health and safetie of their Citizens; of the Liuer, they may learne bountie and liberalitie. For the Braine sitting in the highest place, as it were on a Tribunall, distributeth to euery Organ or Instrument of the Senses, offices of dignity: The Heart like a King maintaineth and cherisheth with his lively and quickning hear, the life of all the parts: The Liuer the fountaine and well-spring of most beneficall humidity or iuyce, nourisheth and feedeth the whole family of the Body, and that at her owne proper cost and charges, like a most bountifull Prince. As for the meaner sort of People, they may easily vnderstand by the ministring and seruile Organs, what be the limits of seruice and subiection. For the parts that are in the lower Belly doe all serue the Liuer; the Stomach doth concoct the meat, the Guts distribute & diuide it, the Veines of the *Mesenterie* prepare it; the Bladder of Gall, the Milt and the Reines, doe purge and cleanse the princely Palace and thrust as it were out of the kitchin, downe the sinke, all the filth and garbage. The parts that are included within the Chest, doe serue the Heart; those that are in the Head, doe attend the Braine, and so each to other doe afford their mutuall seruices. And if any one of them doe at any time faile of their dutie, presently the whole House-hold-gouernment begins to run to ruine and decay.

The euidence of which truth, being by way of *Apologe* or Parable, seasonably represented to the People of *Rome*, by *Menenius Agrippa*, he reuoked them, and laid as it were a Law vpon their furie, when they had gathered themselves into the Mount (which afterwards was thereupon called *Sacer*) hardly brooking the gouernment of the Senate. So that Anatomie is as it were a most certaine and sure guid to the admirable and most excellent knowledge of our selues, that is, of our owne proper Nature. And therefore we read, that valiant and couragious Princes, worthy and renowned Nobles, yea and inuincible Emperors, being moued and enticed with this desire of the knowledge of themselves, did most studiously practise this worke of Anatomie, euen in the noyse and clattering of weapons and armor, and in the verie medly and tumult of warre.

Alexander the Great, among all the maine and great triumphs of his so excellent achievements, gloried that he had diligently obserued vnder his Master *Aristotle*, the nature

How to vse
our senses.

Why the eyes
are set in the
top of the
Body.

Why two
eares.
Why but one
tongue.

How much
the knowledg
of Anatomy
auayleth
Kings and
Princes.

What Kings
and Princes
haue practi-
sed Anatomy.

and feuerall parts of liuing Creatures. And it is found in the Records and Monuments of ancient Histories, that the Kings of the *Egyptians*, did make dissection of Bodyes with their owne hands. *Marcus Antonius* that great Commander, affirmed that he had learned his owne constitution by the dissection of other Bodyes. We haue also read, that *Boetius* and *Paulus Sergius*, two *Romane* Consuls, were Auditors of *Galen*, when he publickly practised this dissection in the Citie of *Rome*. And so much shall suffice for the first profit and commoditie that we may reape by Anatomie.

CHAP. VI.

How profitable and helpfull Anatomie is to the knowledge of God.

How profitable
Anatomy
is to the know-
ledge of God.



It is no doubt an excellent thing for a Man to attaine to the knowledge of himselfe, which thing Anatomie and dissection of Bodyes doth teach vs, and as it were point out vnto vs with the finger; but there is another farre more diuine and vsefull profit of Anatomie, proper and peculiar to vs to whom the Light of the Gospel hath shined, namely, the knowledge of the Immortal God. That high Father & Creator of all things, who onely by himselfe hath Immortalitie, dwelling in that Light that is clearer then all lights, vnto which there is no access, whom no Man can either see with his eyes, or comprehend with his mind, that eternall Father (I say) cannot be knowne but by his effects; and all the knowledge of God that can be had, must be deriued not *à priori*, but *à posteriori*, not from any cause or matter preceding, but from the effects and things consequent.

Moses.
Paul. ad Rom.

So we read in the sacred Scriptures, that *Moses* could not endure the bright shining face of God, his eyes were so dazled therewith. *The inuisible things of God* (saith the Apostle) *are knowne by those things that are visible*. Who is it therefore, that will not honor, reuerence and admire the Author and Workman of so great a Worke, if he do attentively aduise with himselfe, how wonderfull the Fabricke and structure of Mans body is? *I will prayse thee, O Lord* (saith that kingly Prophet) *because I am wonderfully made*. *Phidias* his *Minerua*, *Apelles* his *Venus*, *Polycletus* his *Rule*, are admired by Antiquitie; and therefore great and high honors haue been decreed vnto them. *Ctesicles* is commended for making a marble Image with such excellent art and cunning, that the *Samian* young men in desire to obtaine the same, were contented to lodge night by night in the Temple. And wilt not thou admire the Archtype and patterne of all these, I meane the Body of Man? They did imitate in the workes of Nature, that which is of least respect and regard, namely, the outward face and feature: for their workes are but dumbe, without motion or life. But by the view of Anatomical dissection, we see & are able to distinguish the variable and diuers motions of Mans body, and those also verie strange and vncouth.

The frame of
Man is Gods
Booke.
Heraclitus.

Some of the ancient Writers, haue dignified the frame of Mans body with the name and title of *The Booke of God*. For indeed, in all Men there appeareth certaine sparkes of a naturall Diuinity, or diuine Nature; as *Heraclitus* witnesseth, who sitting in a Bakers shop and perceiuing some of his Auditors which desired to speake with him, would not come vnto him into so homely a place, *Come in* (saith he) *for euen here there be gods also*. *Iouis omnia plena*, *All things* (saith the Poet) *are full of Iupiter*. For euen in the smallest and most contemptible Creature, there is matter enough of admiration; but yet in the frame of Mans body, there is (I know not what) something more diuine, as wherein appeareth not onely the admirable Power of God, but his Wisdome euen past all beleefe, and his infinite and particular goodnesse and bountie to Man.

Gods admira-
ble power shi-
neth in the
frame of Man

The wisdom
of God in the
workmanship
of the parts.

For his power, it is not onely visible, but palpable also, in that of so small a quantitie of Seed (the parts whereof seeme to be all homogenie or of one kind) and of a few drops of Blood, he hath framed so many and so diuers Particles, aboue 200 Bones, Cartilages yet more, many more Ligaments, a number of Membranes numberlesse, as also the Pipes or Trunkes of the Arteries, millions of Veines, Sinnews more then 30 paire, Muscles almost 400; and to conclude, all the Bowels and inward parts. His incredible Wisdome appeareth in the admirable composition of the whole, made of so many parts, so vnlike one to another. Enter thou whosoever thou art (though thou be an Atheist, and acknowledgedst no God at all) enter I beseech thee, into the sacred Tower of *Pallas*, I meane the Braine

Braine of Man, and behold and admire the Pillars and arched Cloysters of that princely Palace, the huge greatnesse of that stately building, the Pedistals or Bases, the Porches and goodly Frontispice, the foure arched Chambers, the bright and cleere Mirror, the Labyrinthean Mazes and web of the small Arteries, the admirable trainings of the veins, the draining Furrowes and Water-courses, the liuing Ebullitions and springings vp of the Sinnewes, and the wonderfull fecunditie of that white Marrow of the Backe, which the Wise-man in the Booke of the Preacher calleth the Siluer cord. From the Braine, turne the Eye of thy Mind to the Gates of the Sunne and Windowes of the Soule, I meane the Eyes, and there behold the brightnesse of the glittering Cristall, the puritie and neat cleannesse of the watry and glassie humors, the delicate and fine texture of the Iuncles, and the wonderfull and admirable volubilitie of the Muscles, in turning and rowling of the Eyes. Marke and obserue also, the art and curious workmanship appearing in the inward part of the Eare, how exquisitely it is made & trimmed with Labyrinths, windings, little windowes, a sounding Timpane or Timbrill; three small Bones, a Stirrop, an Anuile and a Hammer; the small Muscles, the Nerue or Sinnew of Hearing, and the Cartelaginous or gristle passage, prepared for conueying all sounds vnto the Sense. Looke vpon the vnweariable and agile motions, the conquering power, the frame and composition of the Muscles, the proper and peculiar kind of Flesh, the Membranes, the Veines & Sinnewes, and the Bridle, all easily distinguished within the compasse of that little Body, or rather little member of the Body, the Tongue, wherewith we blesse God, and wherewith we curse Men.

Consider and obserue the Heart, his two Ventracles, Eares as many, foure notable vessels, which, as *Hippocrates* saith, are as it were ποταμοὶ καὶ πηγαὶ φύσεως ἀνθρώπου, the Fountaines and Well-springs of the humane Nature, and the Riuer and sources whereby the whole Body is watered and refreshed; besides, 11 Flood-gates; the admirable and intricate Textures of the vessels of the Liuer, the separation and diuision of the currents of the Arteries and the Veines; and in a word, consider the admirable structure of all the parts, Animall, Vitall and Naturall; wilt thou not cry out, though it be against thy will, O admirable Archite& ! O vnimitable Workman ! And wilt thou not with the inspired Prophet, sing vnto the Creator this Hymne, *I prayse thee (O Lord) because thou hast shewed the greatnesse of thy wisdom in fashioning of my Body?*

Lastly, the infinite goodnesse and bountie of God shineth in this excellent workmanship, for that he hath so well provided for all the parts, that euerie one hath her proper and peculiar vse, and yet all are so fitted and knit together in such an harmonie and agreement, that euerie one is ready to helpe another; and any one of them being ill affected, the rest are immediately drawne to a simpathy and participation with it. Which societie and fellowship of the parts, *Hippocrates* in his Booke *De Alimento* hath thus breefly, but excellently expressed, *συνεπείρα, μία, σύμφορα μία, συμπεθεία πάντα*: *One agreement, one consuence, all consenting.* To conclude then, these wonderfull and euer-worthy to be admired workes of God in the composition and frame of Mans body, are as it were dumbe Schole-masters, the Bookes of vulgar Diuinitie, and the Doctors and Teachers of diuine Wisedome.

The elegant
workmanship
of the whole
frame,

Hippocrates
in his Booke
of the Heart.

Gods infinite
goodnesse in
the structure
of the Body.

CHAP. VII.

How profitable Anatomie is to Philosophers and Poets.



Hese two fruits of Anatomie, as they are abundantly beneficiall and profitable, so they seeme to be common to all in generall; First, the knowledge of our owne nature, and then of the inuisible God. There are also other benefits and commodities of Anatomie proper and peculiar to Philosophers, Poets, Painters, yea, and to the most part of Handy-crafts-men and Artificers, to teach them the better to bring their Arts to perfection. And first, *Galen* doth account Anatomie verie proper to a naturall Philosopher, though it were but only for speculation sake, or otherwise to teach him the singular workmanship of Nature in euerie particular part. For in as much as the proper & proportionable subiect of his Art is a Body naturall, and the Body of Man is as it were the square and rule of all other Bodies, he ought not, nor cannot be truly accounted a naturall Philosopher, who is ignorant of the Historie of

Anatomy
very profitable
for a nat-
urall Philo-
sopher.

Anatomy is
profitable for
a morall
Philosopher.

Profitable for
Poets and
Painters.
Homer.

Mans body; and for this cause; that most excellent *Genius*, and Interpreter of Nature, *Aristotle*, wrot those elegant and exquisite Bookes of the Historie of the Parts, and of the Generation of living Creatures. Anatomie is also verie profitable for a morall Philosopher: For he shall easily learne by the mutuall offices & duties of euerie part, and by the constitution of the naturall Household gouernment appearing in our Bedyes, how to temper and order the manners and conditions of the mind, how to rule and gouerne a Common-wealth or Citie, and how to direct a private House or Family.

Isare to speake how profitable it is for Poets and Painters, for the perfection of their Art and Science; for euen *Homer* himselfe hath written many things, and those verie excellent concerning Anatomie. But my purpose is onely to shew, that for a Physitian, a naturall Philosopher, a Chirurgeon and an Apothecarie, it is not onely profitable, but euen also absolutely necessarie.

CHAP. VIII.

Wherein is demonstrated that Anatomie is not onely profitable, but of absolute necessitie for Physitians and Chirurgions.

Hippocrates
De Locis in
Homine.
Hippocrates
De Flatibus.

How necessa-
rie the know-
ledge of the
parts is to the
discerning of
diseases.

Anatomy
necessarie for
Prognosis or
Prediction.

Galen

Necessarie for
curation
Hippocrates

Anatomy
necessarie for
a Chirurgion

AS Geography is worthily accounted a great euident for the credite of an Historie, so to them that any way appertaine to the art of Physicke, the knowledge of Mans body seemeth to be verie necessarie, *ὅτις τις τὸ κοινὸν ἀρχὴν τῆς ἐπιστήμης*. For the nature of the Body is the first thing to be spoken of in the Art of Physicke. Againe, *Hippocrates* in his Booke *De Flatibus*, maketh but one Idea of all diseases. It is onely the varietie and difference of places, that maketh the difference of diseases. He therefore that will be ignorant of the Historie of the parts of Mans body, he shall ill distinguish and discern the affections of the same, worse cure them, and worst of all fore-tell who are likely to recouer and escape, and who not.

The discerning and iudging of a disease, consisteth in two things, namely, the knowledge of the euill affect, and the knowledge of the part so affected. The signes of the part affected, are drawne and deriued from many Fountaines (as it were) but especially from the scituation, and from the action empaiied. For he that knoweth the action of the stomach to be concoction, if the concoction be impaired, he may easily discern that the stomach is ill affected. He that knoweth the Liuer to be placed on the right side of the paunch, if the right *hypocondrium* or side be sore, or doe swell, he will presently affirme, that the Liuer and not the Spleene is ill affected. Now this scituation, as also the actions of all the parts are taught and demonstrated vnto vs by Anatomie onely.

For *Prognosis* or prediction of the euent of diseases, *Hippocrates* maketh three chiefe and maine heads of it: Those things that are auoyded, the action impaired, and the habite of the Body in the colour, figure, and magnitude or quantitie; all which are discerned onely by Anatomie. Now how much the knowledge of the feuerall parts of the Body auaileth towards the curing of diseases, *Galen* hath verie well expressed in the beginning of his Booke *De Osibus*: *πάντα* (saith he) *ἐν τῇ ἰατρικῇ σκοποῦνται τὰ κατὰ φύσιν*, that is, All things that concerne the action of healing, haue that for their scope or direction which is naturally disposed, or in a good and laudable constitution. *Hippocrates* in his Booke *De officina Medici* giueth this rule That the Physitian should first looke into those things that are alike one to another, and then to those things that are unlike: Insinuating thereby, that he that knowes the perfect Sanitie or health of euerie part, shall easily discern if it fall from that perfection, by the perfection which remaineth in other like parts not tainted. *Aristotle* in his first Booke *De Anima*, vsurpeth a rule of Geometry, That which is straight and right (saith he) doth not onely measure it selfe, but bewrayeth that which is oblique or crooked. In like manner, how shall a Physitian restore or set right bones that are broken or out of ioynt, if he be ignorant of their naturall place, figure & articulation? The exquisite method of healing cannot be performed but by Indications, and Indications are not onely deriued from the disease, but also from the part affected, and the remedies must be changed and altered, according to the diuers and feuerall nature, temperature, scituation, connexion and sence of the part.

Neither is Anatomie needfull onely for the Physitian, but euen also for the Chirurgion and Apothecarie. The knowledge of the outward parts, as the Muscles, the Nerues, the Veines

Veines and Arteries, is most necessarie for a Chyrurgion, for feare lest in his dissections and launcings, he should mistake a broad Ligament for a Membrane, and a round Ligament for a Nerue or Sinnew, lest he should diuide an Arterie in stead of a Veine; for he that is ignorant of these things, shall euermore be in doubt; in things safe and secure, still fearfull; and in things that are to be feared, he will be most secure and audacious.

An Apothecarie also shall find it verie needfull for him to vnderstand the scite and figure of the parts, for the better applying of such remedies as shall be requisite. For he must apply his topicall and locall Medicines, Fomentations, Oyntments or Liniments and Emplaisters, in their apt and proper places; as if the Liuer be ill affected, on the right-side; if the Spleene be ill, on the left-side; if the Wombe or Bladder be diseased, then vpon the *Hypogastrium* or Water-courfe, betweene the Nauell and the Priuy-parts; if the Heart be ill affected, then on the left Brest must the remedies be applyed. He must also make his Plaister or other remedy of the same figure that the part affected is of, least the parts adioyning be couered therewithall.

I forbear to speake how profitable and necessarie it is for the explayning of the writings of *Hippocrates*, *Galen* and all the ancient Physitians. For in them there are many passages darke and obscure, whereunto the knowledge of Anatomy will giue a great light and splendor: And therefore in old time, Physitians were wont to propound vnto their young Schollers the Precepts of Anatomy, as the first Rudiments and Principles of the Art of Physicke and Chirurgerie.

Anatomy profitable for an Apothecarie.

Profitable for they vnderstanding of the writings of the Ancients.

CHAP. IX.

With what method Anatomy may be best taught and demonstrated.

BEeing then, the profite and necessitie of *Anatomy* is such and so great, I would perswade all Students, in our Art especially, and in Chirurgerie, that they would verie heedfully and diligently employ themselves in the study of the same; neither shall they need to be deterred or afrighted with the difficultie, for it is verie easie and feasible, if it be layd downe in a good order and method, otherwise the most easie and obuius Art proues hard and obscure. The method therefore of learning and teaching *Anatomy* is on this manner.

The *Art of Anatomy* (as I suppose) may be attained two wayes; by Inspection, which we call *αὐτοψία*, and by Instruction: And both these wayes are verie necessarie, if the perfection of the Art be desired: But the first is the more certaine, the latter carryeth with it greater grace and state: The former may be called the way of Historie, or the Historicall way; the latter, the way of Science, or the Artificiall way. The first, which is Inspection, is either of Figures depainted or carued, and printed on Tables onely, or of the Bodies themselves of Men or Beasts; of Men, onely when they are dead; of Beasts, both dead and liuing, for the better obseruing of the diuers and obscure motions of the inward parts.

In like manner, the way of Doctrine or Science is double; one, by the writings of most famous and renowned Men; another, by the liuing voyce of a Teacher or Instrueter.

The Inspection of Figures some haue disallowed, because they are bare shadows, which in their opinion doe rather hinder then further young Students. For, if *Galen* would not haue Plants or Hearbes painted or desciphered, no nor so much as described, but taught and deliuered by Hand onely: How would he haue endured the delineation of the parts of our Body?

But I am not altogether of that opinion, to thinke these Pictures vaine and idle, because I see euerie day represented vnto mine eyes by these Pictures many things, & those oftentimes of great consequence, which were vnkowne to the skilfullest Artists of former Ages. Neither doe the Geometricians & Geographers, who are but the Anatomists of the Great world, as we are of the Little; despise those demonstrations which in Cards and Maps they receiue one from another. Againe, it is not alwayes, or in each place easie to find and obtaine such store of humane carkasses, and therefore that want is well supplied by a curious draught or delineation of such obseruations, as are made in true dissections by cunning Artists; that so both the memorie of those that were present may be

Anatomy to be attained two wayes, by Inspection and by Instruction.

Galen disallowed Pictures of Plants and Anatomy.

The benefices of Pictures.

Geometricians are Anatomists of the Great world.

A caution.
Comparison

refricated and refreshed, and such as were absent, made also partakers of their Labours; yet for all this, I doe not thinke it fit to trust too much to these silent shadows. For as it is not possible to make a good Commander, or a skilfull Pilot by any typicall or representatiue Army, Fortification or Water-card, but onely by practise and experience: So it is a verie vaine thing to take in hand to learne Anatomy by the bare inspection of Figures, without practise vpon the Body it selfe: And because our Art concerneth the cure not of Beasts but of Men, we must therefore exercise our selues chiefly in the Anatomy of the Body of Man, and that not alieue but dead.

Who vsed to
butcher men
alieue.

The cutting
vp of men
alieue is not
onely inhu-
mane, but also
of no profit
or vse.
Obiection.

Answer.

I am not ignorant that some of the ancient Physitians, as *Herophilus* and *Erasistratus*, by the License of Princes whom they had possessed with the profit thereof, did anatomize the Bodyes of condemned wretches even whilst they were alieue, which also in our Age hath been done (some say) by *Carpus* and *Vesalius*. But for mine owne part, I hold it a very friuolous and vaine thing, beside the horror and inhumanitie of the fact, which almost no necessitie can sufficiently warrant. For liuing dissections (as we call them) are then put in vse, when we would find out some action or vse of a part which by the dead Carkasse cannot be discerned; now all those we may find as well in Beasts as in Men. If it be objected, that there is some difference betweene the actions of Men & of Beasts, especially the Animall; and that the Organ of voluntarie motion, to wit, the Muscles, are not alike in both kinds. I answer, that for the discerning of actions that belong to motion & sense, there is no need of dissection, for they are almost all of them apparent to the senses; onely the motions of the hidden and secret parts, as not being subiect to sense, must be sought out by dissection. Now of those hidden motions, that of the Heart and Arteries, the Midriffe, the Braine and the Guts, which are of greatest consequence, are all one in Men and in Beasts; wherefore it is not Anatomie but Butcherie, to mangle the trembling members of Mans body, and vnder, I know not, what slender and idle pretence of profite or behoofe, to violate the sacred Law of Nature and of Religion.

The ancient Physitians were not allow'd to cut vp dead Carkasses of Men, as we now vse dissection, but it was held a verie impious and prophane thing: How abominable then is it, and fauouring of *Caniball* barbarisme, because we would make a neerer cut to our vnderstanding by our eyes, then by the discourse and labour of our minds, to gather knowledge by the dissection or rather butcherie of liuing Men, if there were any vse of it, as we haue shewed there is none. Let vs therefore content our selues, and giue due thanks vnto our State, by whose Lawes we are allowed dead Bodyes for dissection, euery yeere a competent number: And if there be any where want of such, we may haue resort to the Bodyes of Beasts, and make dissection of them both alieue & dead; alieue more sparingly, all be it by Anatomy of liuing Bodyes, we may better discern the actions of the parts, and by what Muscles euerie part is moued; in the dissection of dead Bodyes, the situation, figure, magnitude, connexion and originall of the parts, are well enough perceived.

Those Beasts
which come
nearest to the
frame of mans
body, are fit-
test to be dis-
sected.

Five sorts of
Beasts ac-
cording to
Galen

The method
of Anatomy.

Lawes and
rules of
Anatomy.

Let young
beginners first
exercise their
hands in the
externall, for
as much as the
know-
ledge of them
is most easie
and necessarie
for a Chirur-
gion.

Now, because there are many kinds of Beasts, those are to be made choyse of for dissection, which come nearest to Mans body. *Galen* reduceth them to five sorts. The first sort is of such as chew the cud, that is, which after they haue eaten their meat, doe bring it againe from the Dew-lap, as from a kind of stomach, backe vnto the mouth, as Sheep and Oxen. The second sort is of those which diuide not the Hoofe, as Asses, Horses & Mules. The third sort are such as haue teeth in manner of a Saw, as Lyons, Dogges and Wolues. To the fourth sort, he referreth Hogges. To the fifth, Apes. Now the dissection of all, or any of these, whether Man or Beast, is not to be taken in hand confusedly and disorderly, but methodically & with a due course of proceeding, and therefore it shall not be amisse, to prescribe some Lawes and Rules of Anatomy, for the better and more orderly practise and exercise of the same.

This therefore, to begin withall, shall be the most generall and common Rule, that we begin with that which is best knowne, and that the dissection of dead Bodyes goe before that which is of liuing Creatures, because it is more easie and better knowne.

Againe, whereas some parts are externall and outward, others internall and inward: Let young beginners first exercise their hands in the externall, for as much as the knowledge of them is most easie and necessarie for a Chirurion.

Thirdly, whereas of the parts some are spermatieall and solid, as Bones, Gristles and Ligaments; others fleshy, as the Muscles: We must begin with those that are the props

and

and supporters or vpholders of the rest, as the Bones, to which the Muscles doe cleave, from which they spring and arise, and into which they are ingrafted or inserted. And indeed, before *Galens* time, the ancient Physitians in the Schoole of *Alexandria*, did vse to quarter Bodies for their Schollers first, and afterward allow them whole Carcasses. Againe, we must know, that for the exquisite discerning of the solid parts, the Bodies of old and leane Men are the fittest, because they are not so fleshy or so over-growne with fat; to which are answerable the Bodies of such as dye of Consumptions.

Fourthly, whereas there is a two-fold dissection, either of a part taken from the whole, or of a part ioyning to the whole: The dissection is first to be made of a part taken from the whole, because it is more easie then to dissect a part ioyning to the whole.

Fifthly, whereas in euerie particular part *Galen* enioyneth three things to be obserued and respected; the Structure, the Action and the Vse: The Anatomist must first search out the Structure or composition, then the Action, and lastly the Vse.

Lastly, in making dissection, there is a two-fold order to be obserued: The one, where there is store of dead Bodies; the other, where there is want and scarcitie. If there be store of Bodies, you shall in one looke onely to the Vessels, in another to the Muscles, in a third onely to the Bowels or Entrails: But if you haue but one Body and no more, and yet would see all in that, choose a Body that is sound and vntainted, and either hanged, smothered or drowned; and in this Body great skill must be vsed, that euerie part may be shewed in his order and place. Now this order of Anatomy is three-fold; of Dignitie, of Scituation or Dissection, and of Preseruacion or Continuance. The order of Dignitie requireth, that we should begin with the Braine, as with the most noble part. The order of Scituation or Dissection requires, that we should first demonstrate those parts which first appeare in view to the beholders. And for Diurnitie, if we would keepe a Body long, the dissection must be begun at those parts which are most subiect to Corruption: and therefore, first cut vp the lower Belly, then the Chest, after the Head, and lastly the Ioynts. This order all Anatomists doe obserue in Schooles, and in all publike dissections, when as they desire to shew all, or the most part, in one and the same Body: And this is the first method or order of learning Anatomie, namely, by Inspection, which is gayned by Dissection.

Anatomy may also be taught without dissection, and that either *vina voce*, by the liuing voyce of the Teacher, or by writing. For there are many things which cannot be knowne by Inspection alone, which may notwithstanding in good and apt words be taught, and so compassed; as namely, why the Muscles are such and so many, why of such Figure, Magnitude, and the like: And for this cause, the Monuments and Labours of old and new Writers in this kind, must be diligently trauelled in; whose Names I intend to declare in the next Chapter. Now Anatomie may be described and so taught after a two-fold method. The one is called the way of *ἀνάλυσις* or resolution, which resolueth the whole into his parts; as when we diuide the Body of Man into foure principall parts, the Head, the Chest, the Belly and the Ioynts; and these againe we sub-diuide and mince smaller and smaller, till we come to the most simple, ynmixt and uncompounded parts. The other is called *σύνθεσις*, or the way of composition, which of similar parts maketh dissimilar, and of these compoundeth the whole frame and structure. But we esteeme this last not to be the way of *Art*, but of *Nature*; and therefore leave it to her who is onely able to performe it. The former belongeth vnto vs, as being the way of Art, for we intend not to make a new Man, but to preserue and keepe a Man already framed and made: And therefore as he that commeth to an old yet stately Palace which he is not able to imitate, to repaire and amend the same, doth first take off the coverings, that so he may looke into euerie corner and see the defects of it, that he may apply himselfe better to the reparation: So we will first remoue the couer and shrine of this sacred Palace, & after looke as narrowly as we can, into the secret corners of the same, that when we are called, we may be better able to set our hands to the worke: And yet after we haue ended our whole discourse, we will also giue you a view (as well as we may) of the worke of Nature, iterating the Figures and their explications which are disperfed through the whole worke, but much more largely, according to the order of *σύνθεσις* or composition, that nothing may be wanting vnto you, which either our industry or charge may accomplish for our behoofe; but first we will insist in order of Dissection.

The Schoole
of Alexandria

The order of
Anatomy
three-fold.

How we may
attaine the
skill of
Anatomy
by instruction

A two-fold
method of
teaching
Anatomy.
Analysis.

Genesis.

Comparison

CHAP. X.

Who haue written of Anatomie; And first what HIPPOCRATES hath written thereof.

The prayse of
Hippocrates

Hippocrates
writings like
to Seed.

Galen

Hippocrates
not ignorant
of that Ana-
tomy which
is vsfull and
profitable.

How Hippo-
crates descri-
bed the nature
of Bones.

Hippocrates
description of
the Back-bone



Hippocrates of Coos was reuerenced by Antiquitie as the Oracle of Greece, or a kind of Deitie, rather to be adored then admired, much lesse imitated. This Man, when the Art of Physicke was yet rude and vnpolisht, so labored vpon it, that he left it smooth and terce: The knotted bud, by the strength of his wit and vigorous rayes thereof, he made to spread into a glorious flower. He like a good Husband, hath reduced the seeds of Physicke, dispersed before in the large Field of the World, into certaine Seed-plots, whence we may fetch them one by one at our pleasure: And truth to say, his writings resemble seed most of all, for they are not great, but full of power and efficacie: For as a small Acorne hath in it the power of a mightie Oake, so in him one short Aphorisme consisting of a few words, hath growne to fill whole Volumes of Commentaries; and so all other his writings are verie enigmaticall, hauing in them as many sentences as words. Before Hippocrates time, the knowledge of Anatomie was verie geason and scarce: No writings of the Ancients were extant of that subiect. He was the first Man, that being inspired (as I verily thinke) with a diuine Spirit, and trusting (as well he might) to the strength of the pinions of his owne wit, cut the first way through this Abyffe; not onely leauing encouragement vnto others, but also monuments of many things which pertained to Anatomy. For I verily thinke, that that happy Spirit of Hippocrates, was ignorant almost of nothing that doth necessarily appertaine to the vse and practise of the Art of Physicke. For whereas Galen in his second Booke *De Anatomicis Administrationibus*, maketh two sorts of Anatomy; the one profitable, because it is necessarie for the practise of Physicke; the other, beyond the vse of Art, and more for ornament and pleasure, then profit which he calleth *Superabundant*: I presume I can demonstrate vnto you, that Hippocrates hath most exquisitely and elegantly described that former profitable and vsfull kind of Anatomy.

Of parts some are Similar, some Dissimilar; Similar, are the Bones, Cartilages, Ligaments, Membranes, Veines, Arteries, Nerues; and of all these Hippocrates hath written many things, and those excellently well. Concerning the Bones first in generall, what is their Nature, their manner of Generation, their materiall Cause, their Efficient, and finally, their Vse, he hath excellently demonstrated in his Bookes *De Natura Ossium*, *De Carnibus*, and *De Natura Pueri*. The matter he describeth in these words; *When the Fat exceedeth the Glue, then are the Bones framed*. The efficient cause hath he thus set downe, *τα ὅσα σκληρύνεται ὑπὸ τῆς θερμότητος τοῦ πυρρῶς*, that is, *The Bones being thickned by heat, are exiccated or dried*. The common vse of the Bones, who did euer so accurately expresse in so few words, *τα ὅσα τὰ σώματι στήναι καὶ ὀρθοῦν καὶ εἶδος παρέχονται*, that is, *The Bones doe giue vnto the Body, stabilitie, vprightnesse, and forme or fashion*. He hath also described the particular Historie of the Bones, their seuerall differences, their fashions and their parts. Of the Bones of the Head, he writeth in his Booke *De Vulneribus Capitis*. Of the rest in his Bookes *De Articulis* and *De Ossium Natura*. For before he doe deliuer the diseases or affects incident to the Bones, he enquireth into the nature and fashion of euerie Bone: A tast of which his elegant order, I will giue you in the description of the Back-bone, whereby you may imagine how he hath done all the rest.

The nature of the Back-bone (saith he) *is first to be knowne*. The Figure of it is *θυσκοῦς*, that is, *in some sort right and straight*, but yet so, that sometimes it bendeth outward, sometimes inward. From the first Rack-bone or *Vertebra* of the Neck, to the seuenth, it hath *Figuram λοφῶν*, that is, *Inclining inward*, that it might be substrated or couched vnder the Gullet and the rough Arterie. From the first Spondill of the Backe, vnto the twelfth, it hath *Figuram κωφῶν*, that is, *A forme bunching outward*, that the Organs of respiration might haue the better roome, and a more spacious cauitie to extend themselves in, to wit, the Heart and the Lungs.

The Loynes bend inward, and the *Os Sacrum* or Holy-bone, protuberateth or swelleth outward, yet with a straightnesse too, that so the cauitie of the *Hypogastrium* or Water-course might be the larger, which was to containe the Bladder, the right Gut and the Wombe. The rest of the Bones he pursueth after the same manner.

Concerning

Concerning the Cartilages, Ligaments and Membranes, some things he hath deliuered here and there, but scatteringly. Of the Veines he hath written many things, but all of them verie obscure, in his Booke *De Locis in Homine*, *De Morbo Sacro*, *De Ossium Natura*, and in the second *Ensisquid*. And first, he doth verie elegantly describe the ascendent and descendent Trunke of the hollow Veine, which he calleth *ηρσιν*, that is, *The Liuer-veine*; in the fourth Section of the second Booke *Epidem*. *The Liuer-veine* (saith he) *passeth downward through the Loynes, to the great or Holy bone*. Again, *Arising upwards out of the Liuer, it ascendeth through the Midriffe, and so runneth to the Throat*. As for the particular Historie of the Veines, that is to say, the diuification of their Branches; albeit he hath not precisely set them downe, yet it seemeth he was not ignorant of them, so farre as was needfull for the practise of Physicke: For he mentioneth all those Branches which Physicians vse to diuide in Phlebotomy; as for example, the Veines of the Fore-head, the Nowle or back-part of the Head called *Vena puppis*, and we may call it the Sterne-veine, the Veines of the Tongue, the Eares, the Iugular or Throat-veines, the Shoulder-veine, called *Humeraria*, the Liuer-veine, called *Basilica*, that of the Ham, called *Vena poplitia*, and the Ankle-veines, called *Malleoli*. In the 68 Aphorisme of the first Section, *when the back-part of the Head is pained, the right Veine of the Fore-head being opened giueth ease*.

In his third Booke *De Morbis*, in the *Angica* or *Squinancy*, he striketh the Veines vnder the Tongue. In his Booke *De Aere, Locis & Aquis*, he mentioneth the Veines behind the Eares, which the *Scythians* did vse to open, to helpe the *Scyatica* or Hip-gout. The Iugular Veines, he describeth in the fourth Booke *De Morbis*. In his Booke *De Natura Ossium*, he commandeth to open the Veines of the Hams and Ankles, in paines of the Loynes and Testicles. In the first Section of the sixth Booke *Epidemion*, in fits of the Stone, or inflammations of the Kidneys, he openeth the Ham-veines. The Shoulder-veine he describeth in his Booke *De Ossium Natura*, calling it *Sanguifusus* or the Blood-flowing-veine. In his Booke *De victus ratione in morbis acutis*, in the Plurisie he openeth the *Basilica* or Liuer-veine, which he calleth *την εσω ολβη*, that is, *the inner or internal Veine*. Now the common originall and vse of the Veines, he declareth in his Booke *De Alimento*, as also of the Arteries, *εξωσις φλεβων ηπαρ, ελξωσις αρτηριων καρδιαν*, that is, *the radication or root of the Veines is the Liuer, of the Arteries the Heart*: Out of these, Blood, Spirits and Heat are distributed into the whole Body. Of the Nerues you shall read many things, yet dispersedly: But for their common originall (which all Men were ignorant of) he pointed it out manifestly. All Men almost doe hold, that the softest Nerues or Nerues of Sense, doe arise from the Braine, the hard and such as serue for motion, from the *Cerebellum* or little Braine: But now it is resolved, especially since *Varolius* his curious search by a new manner of Anatomizing the Head, that all the Nerues, euen the *Opticks* themselves, doe arise from this *Cerebellum* or backward Braine, which me thinks *Hippocrates* insinuateth in his Booke *De Ossium Natura*. *Νευρων εκευσις* (saith he) *απο τεινς αρχης παρ εδχιν εστ*, *The originall of the Nerues, is from the Occipitium or hinder part of the Head, euen to the Rack-bones, the Hips, the Priuities, the Thighes, the Armes, the Legges and the Feet*. Of Glandules or Kernels, he wrot an entire Booke. And so much of the Similar parts.

Of the Organicall parts also he wrot much, and that excellently. Of the Heart a Golden Booke, wherein he so excelleth, that I thinke neither *Galen* nor *Vesalius* haue gone beyond him for exact description; but in it there are many things obscure, which needs an Interpreter, if the World were so happy. The Historie of the Infant, the Principles of Generation, the Conceiuing, Forming, Nourishment, Life, Motion and Birth, hath he most excellently described in his Bookes *De Natura Pueri*, *De Septimestri* and *De Octimestri Partu*. We conclude therefore, that *Hippocrates* wrot verie diuinely of Anatomy, but withall so obscurely, as his Workes euen to this Age, seeme to be sealed from the greatest wits. I thinke therefore that he shall merit most of Physicke, who hauing all his furniture about him, shall labour to make manifest to the World, those diuine Oracles, which hitherto we haue rather admired then vnderstood.

The description of the hollow veine after Hipp.

Hippocrates knew all the veines which are usually opened

Instances in them all.

The Scythians cure of the Scyatica.

Hippocrates discovered the originall of the Nerues.

Varolius commendation.

Hippocrates Golden Book of the Heart.

An exhortation to take paines in Hippocrates

CHAP.

CHAP. XI.

What GALEN hath written of Anatomy, and how uniuersally he is accused by the latter writers, especially by VESALIUS.

The prayse of
Galen



Three things
accomplishing
an Anatomist

Almost all the Grecians, Arabians and Latines, doe verie much extoll *Galen*, as after *Hippocrates*, the second Father of Physicke; for as much as he hath in such sort amplyfied and adorned the whole Art by his deepe and diuine Writings, that vnder him it may seeme to be as it were borne anew. For indeed, how be it there were extant before many excellent Monuments and Records, yet were they so confused and shuffled out of order, that it seemed a new worke to gather together those things that were disperfed, to illustrate that which was hard and difficile, rude and vnpolisht; to distinguish and order that which was confused, beside many things which he obserued in his owne particular experience. For other parts of Physicke I will say nothing, but for Anatomy I will confidently auouch, that *Galen* hath so beautified and accomplished it, that he hath not onely disperfed the blacke clouds of ignorance which hung ouer the former Ages, but also giuen great light and splendor to the insuing Posteritie. For whereas there are three meanes, which lead vs as it were by the hand to the perfect and exact knowledge of Anatomy, namely, Dissection of the parts, their actions and their vses: He hath so accurately described them all, as he hath gotten the prize from all Men, not onely before him, but even after him also. The manner of Dissection, he hath manifested in his Bookes, *De Anatomicis Administrationibus*, *De Dissectione Musculorum & Nervorum*.

The actions of the seuerall parts, he hath elegantly described to the life in his Booke *De Naturalibus Facultatibus* and *De Placitis Hippocratis & Platonis*. But aboue all, are those 17 golden Bookes of the *Vse of Parts*, which are truly called Diuine labours and Hymnes sung in prayse of the Creator. So that the benefits we all, and those before vs haue receiued by *Galen*, are indeed verie great: And yet (the more the pittie) almost all the new Writers, doe continually carpe and barke at him, yea teare and rend him, whether it be by right or wrong, wounding and launcing his credit vpon euerie slight occasion: One by way of cauill, another ambitiously seeking to make himselfe esteemed by *Galen's* disgrace, and few with any desire that truth should take place. But as Floods beating against the Rockes, by how much they rush with greater violence, by so much they are more broken and driuen backe into the Maine; so, and such are their bootlesse and ridiculous endeauors, who enterprize by the disgrace of another, especially of their Masters and Teachers, to gaine reputation vnto themselues.

The slander
of the new
Writers
against
Galen

The confuta-
tion of the
first slander.

But let vs see wherein these Nouices doe blame *Galen*. First they say, he hath giuen vs onely the Anatomy of brut Beasts, and not of Man, hauing neuer dissected a Mans body. Again they vrge, that he was ignorant of many things, which at this day are generally and commonly knowne. Thirdly they say, he deliueres many things repugnant and contrarie to himselfe. Lastly, that he hath written all things confusedly & without method or order. For (say they) what method can there be obserued in his Bookes of the *Vse of Parts*, which you call Diuine? First, he treats of the Hand, then of the Legges and Feet, and last of all of the lower Belly and the naturall parts. How silly these calumniationes are, and how miserably these Men are by their owne ignorance deceiued, let all Men heare and iudge. For to begin with the first, I say and affirme, that *Galen* did not onely cut vp the Bodies of Apes, but many times also the Carcasses of Men. My witnesse shall be the Author himselfe. In his 13 Booke *De Vsu Partium*, I am determined (saith he) to set forth the structure and composition of Man alone. In his first Booke *De Anatomicis Administrationibus*, it is meet to obserue and looke into euerie Particula, especially in Men. In the second Booke, Now (saith he) the Foot of an Ape differeth from the Foot of a Man, in that the structure of the Fingers is not alike in them both. In his fourth Booke *De Anatomicis Administrationibus*, and in the third *De Vsu Partium*, he sheweth the difference of the Tendons which goe to the Legges and Feet: And in his first Booke *De Anatomicis Administrationibus*, he saith, that the head of the Thigh is more crooked in Men then in Apes, and the Muscles also vnlike, which are inserted into the Legges. He sheweth also the dissimilitude betweene the Loynes of a Man and an Ape. In his second Booke *De Ratione Vetus*, he saith, that a Man differeth from some Creatures in the

the originall of the Veine called *Azugas*, that is, the solitarie veine, or without a peere. In the 13 Booke *De Vsu Partium*, he saith, That the wombe of a woman, differeth much from that of other Creatures.

So then, if *Galen* did so well vnderstand wherein the Bodyes of Men and Apes did agree, and wherein they did disagree, it is verie likely that he had made dissection of Mens bodyes: for in things which are so like, it is the part onely of an Artist and expert Practitioner, to know and discern what is differing and vnlike. And so much for satisfaction to the first imputation which is iniuriously cast vpon *Galen* by his slanderous detractors. They say farther, that *Galen* was ignorant of many things which appertaine to the structure and composition of Mans body; as if it were not proper to Man to be ignorant. Was not *Vesalius* ignorant of a number of things which were afterward obserued and seene into by *Fallopins*? And doe we not daily find out many things whereof the former Ages were vtterly ignorant? I appeale to that of the ancient Poet, *ἄνθρωπος πάντῃ ὀπῶν*, One Man seeth not all things.

And whereas they object, that *Galen* doth not agree with himselfe, but writeth many things repugnant and quite contrarie, let them learne and be aduertised, that it was the manner of the Ancients, to deliuer many things diuers times according to the opinion of other Men: And the Interpreters beare record, that *Hippocrates*, *Aristotle* and *Plato*, did many times speake after the manner of the common people. So *Galen* speaking according to the opinion of others, may haply write some things that doe not so well agree together: But when he disputed precisely of the point of Anatomie, then he alwayes agreeth and accordeth with himselfe.

Lastly, they clamor that his Bookes *De Vsu Partium*, are written confusedly and without method: But their heat & furie of gain-saying, transports them I know not whither: For the method of these Books is admirable, which being to many heretofore vnkowne, I will now make plaine and bring to light.

I am determined (saith *Galen*) to declare the structure and composition of Man, and the vse of all his particular parts; and therefore what he hath proper and peculiar therein, and wherein he differeth from other Creatures, must first be opened.

First therefore, for the nakednesse of his Soule, he hath Reason, which is an Art before all Arts, and in recompence of the nakednesse of his Body, he hath the Hand, an Organ before all Organs. Of the Hand therefore which Man alone hath, and no other Creature beside, he disputeth in his first and second Bookes, so accurately and elegantly, that he hath preuented all Men for getting any honor by treating of that subiect. And, because the Legges haue a great affinitie with the Hands, and that there is some thing proper and peculiar in the frame and structure of the same, (for onely Man by the benefit of his Legges, goes directly vpright) therefore in his third Booke, he intreateth of the Legges; for so the order of teaching seemeth to require, that those things which are alike, should be deliuered together.

Having declared what things they are which are proper to Man onely, he commeth then to such as are common vnto Man with other Creatures. And whereas of those parts whereof the Bodyes as well of Men as of other perfect Creatures are composed, some doe preserue and maintaine either a particular and indiuiduall Creature, or the generall species or kind; others doe seruice and administer vnto the former, as the Veines, Arteries and Nerues: In the first place, he disputeth of those that concerne the *indiuiduum* or particular Creature: And these are either Naturall, or Vitall, or Animall; by reason whereof, the Body is diuided into three Regions. Of the Naturall parts, he disputeth in the fourth and fifth Bookes; Of the Vitall, in the sixth and seuenth; Of the Animall, to wit, the Braine, in the eighth and ninth: Of those things which depend vpon the Braine, that is, of the Instruments or Organs of the Senses, in the tenth, eleuenth, twelfth and thirteenth Bookes; which may be called the order of Nature. The Organs ordained for generation or propagation of the species or kinds, as well in Men as Women, are described in the fourteenth and fifteenth Bookes. Those parts that are seruiceable to all these, as the Veines, Arteries and the Nerues, are delineated in the sixteenth. The seuenteenth, which is the last, serueth as an Epilogue or conclusion to all the rest: And therefore, these slanderous accusers of so worthy a Writer, are no better worth, then to be sent packing from all societie of ingenuous learned Men.

The confutation of the second slander.

A custome of the Ancients

Galen himselfe cuer agreeth with himselfe.

The wonderful method of the Bookes of *Galen De Vsu Partium*.

CHAP. XII.

How farre ARISTOTLES skill stretched in Anatomie.

The praise of
Aristotle.Aristotle was
ignorant in
the particular
Historie of
the Creature
and in Dissec-
tion.

Aristotle is intituled by all Philosophers, the true Interpreter of Nature, the Light, the *Genius*, the onely spirit of truth, who is able not onely to stirre vp and awaken Mens minds, but to fulfill and satisfie them. In a word, he is another Nature, furnished with eloquence. For he hath verie curiously determined of all naturall things and their causes; but that so darkely and obscurely, that he is vnderstood but by few; for he was vnwilling to blab abroad and prophane the Mysteries of Philosophy amongst the rude multitude; and therefore he hid them, not vnder a veile of Fables, as the ancient Poets; nor vnder a superstitious proportion of numbers, as the *Pythagoreans*, but wrapped them vp in obscure breuitie; so sending them abroad, as if he had kept them at home. So the Cuttle-fish to deceiue the Fisher-men, poureth forth a blacke humor, and in that cloud she escapeth. And whereas there are two parts of naturall Philosophy; the first concerning the generall and vniuersall nature of things, the latter which searcheth out the particular nature of Man and all liuing Creatures: In the first, *Aristotle* was so absolutely excellent, as no Man, no, nor any age of Men may stand in competition with him; but in the second, how many things he knew not, how absurdly he vnderstood diuers things he knew, *Galen* and all the whole Schoole of Physicians haue proved by demonstrations, but especially by *αὐτοψία*, or the sight of the eye, which is of all arguments the most demonstratiue. He writ Bookes of the Generation, of the Parts and of the Historie of the Creatures, but he bequeathed vs many things out of the Testaments of other Men: Neither is it likely, that he did euer cut vp the Body of a Man; for if he had, he would not haue so foully erred in that which is obuius to the fence. For both in the Historie of the similar parts, and in the description of the dissimilar, he hath set downe many things verie grosse and absurd; as in that, where he writeth, that the Veines doe originally proceed from the Heart, which also he maketh the well-spring of the Nerues; where he saith there are three Ventricles in the Heart; that the Braine was made onely to refrigerate or coole the Heart, and such like many more, which we shall meet withall in our treatings of the Bones, the Veines, the Arteries, the Nerues, the Heart, the Braine, and other particular parts; and therefore in those places, the diligent and studious Reader may looke for, and find them.

CHAP. XIII.

What the other Greeke Authors haue written of Anatomie.

Alcmaus.
Diocles.
Lycus.
Galen.Quintus.
Marinus.
Erasistratus.
Herophilus.Pelops, Galens
Scholemaster.
Diog. Anoll. n.
Asclepiades.
Endemus.
Praxagoras.
Philotimus.
Elianus.
Polybius.
Calistus.

There were after *Hippocrates* time, certaine famous Men, that did diligently practise the Art of Anatomie, and diluiered many things in writing, which haue all perished, I know not by what mishap or destinie, whether I should call it. *Alcmaus Crotoniata* (as *Calebidius* reporteth) did vse to Anatomize Mens bodies. *Diocles Carystus* in his Epistle to King *Antigonus*, diuideth the Body of Man into the Head, the Chest, the Belly and the Bladder. *Lycus Macedo* was accounted cunning in the dissection of the Muscles; and his Bookes (as saith *Galen* in his fourth Booke *De Anat. Administ.*) were with great commendation dispersed all abroad. *Quintus*, *Lycus* his Schoolemaster, wrot some things of Anatomy. *Marinus* published 20 Bookes of those things which *Lycus* was ignorant of in Anatomy. *Erasistratus* did much in this kind also. *Herophilus* (as *Tertulian* saith) cut vp aboue 70 Bodies, and oftentimes the Bodies of liuing Men. Of him *Galen* writeth thus: *Herophilus as well in all other things that appertaine to our Art, as also in Anatomy, did attaine to a most exact and exquisit skill and knowledge, and for the most part made his experiments not in bruit Beasts, as most Men vse to doe, but euen in the Bodies of Men.*

Pelops did publicly teach Anatomy, and was the Schoolemaster of *Galen*, he affirmed, that all the Vessels of the Body, did originally arise from the Braine. *Diogenes Apollonata*, wrot a Booke of Veines. *Asclepiades*, *Endemus*, *Praxagoras*, *Philotimus*, *Elianus*, *Polybius*, *Calistus*, in their seuerall times, did all of them excell in this Art. Yet none of their

writings

writings remaine with vs; but if we beleuee *Aristotle* and *Galen*, they had many foolish and ridiculous conceits. There haue beene also *Greekes* of latter times, who haue done somewhat in Anatomie, as *Aretaeus*, *Theophilus*, *Oribasius*; but *Galen* hath won the Girland from them all, as we haue already proued.

Aretaeus.
Theophilus.
Oribasius.

CHAP. XIII.

Who haue beene the chiefe Authors of Anatomy in our owne times.



Any things also haue the *Arabians* written of the matter of Anatomy, of whom *Auicenna* is worthily accounted, especially for the speculative part, the Prince and Chieftaine; but amongst all, the *Latines* haue taken most paines in this Argument, and amongst them, those of our owne Age; so that now the Art is so beautified,

Auicenna.
Latine
Writers.

that it seemeth the last hand is put vnto it, and the Art of Anatomy may now be accounted to haue attained the verie height of her glorie. Among the ancientest of them, we haue *Mundinus*, who wrot verie perspicuously by way of *apud* or resolution, following the order of dissection. *Carpus* wrot large Commentaries vpon him; but we must needs take them both with many idle and absurd passages, besides the lameness and imperfection of their workes. *Thomas de Zerbis* set forth a large worke, but we imagine that he tooke much from other Men, and had little of his owne, neither had he as we suppose, any great practise himselfe in Dissection. After these came *Vassius*, *Carolus Stephanus*, *Andernacus*. At length appeared *Andreas Vesalius*, who wrot verie accurately; and some thinke, he balked nothing that may appertaine either to Dissection, or to the actions or vse of the parts; but he is condemned of many, and haply not vnworthily; for that hauing transcribed almost all his workes out of *Galen*, yet he cannot afford him scarce a good word, but either pricked by Ambition, or with an itching desire to contradict so great an Authour, he neuer leaues goading and wounding his reputation, and that verie often vnderstandedly.

Mundinus.
Carpus.

Th. de Zerbis.

Vassius.
C. Stephanus.
Andernacus.
Vesalius.
an accurate
Writer.

Iacobus Sylvius herein hath carryed away the reputation, that he hath digested in a most exquisite order, the vast and wild Forrest as it were, and confusion of all the Muscles and Vessels, and giuen them particular and proper names, but he was little beholding to his Printer, who hath let slip many escapes, and by your leave added (as we thinke) some things to him verie superfluous. These two, *Vesalius* and *Sylvius* flourished both in one time; but *Vesalius* was too tart and sharpe in his calumniationes; *Sylvius* too obstinate a defender of *Galen*. *Vesalius* hath rashly and vnadvisedly written many things against *Galen*, *Sylvius* in defending his Master *Galen*, is enforced to maintaine many vncouth Paradoxes. *Gabriel Fallopius* the most subtile and acute Anatomist of this Age, hath deserved exceeding much of vs all; for in his obseruations he hath opened many things altogether vnkowne to the former Ages: He wrot also an excellent Commentarie vpon *Galen's* Booke *De Ossibus*. *Columbus* couched the whole Art verie succinctly in 15 Bookes, and penned them verie neatly. *Valuerda* the Spaniard hath done also exceeding well, and with great commendations. *Eustachius* hath published some small workes of Anatomy concerning the Bones, and the frame and composition of the Kidneys. *Baehnius* first exceeded all Men, and since in a later worke, hath exceeded himselfe, both in his Descriptions, and in his Tables. *Archangelus Picholomineus* a Citizen of Rome, hath set forth verie learned Readings of Anatomy, interlaced with many disputations concerning things controuerted. *Varolius*, *Arantius* and *Pigafeta* haue added also their Tribute vnto this Treasure. *Volcherus Coeitur* and *Felix Platerus* haue beautified it with their Tables: *Volcherus* is more easie and facile: *Platerus* is accurate, but not fit Lettuce for euery Mans lips, he must pick nicely that will gather a Sallet out of him, he is so intricate and full of his Dicotomies. Many Frenchmen haue written well in their owne Language. *Iacobus Guillemaeus* the Kings Chyrurgion, hath adorned the whole Art with Tables and Figures, by which he hath made an easie entrance for all Men to vnderstand the grauest Authors. The like may be said of that industrious *Paracelsus*, and *Cabrolus* the Kings Anatomist in *Mompelier*. *Seuerinus Pinus* hath taken great paines: He wrot a Booke of the notes of Virginitie, wherein he hath verie curiously described the parts belonging to Generation.

Sylvius
his commen-
dation.

Fallopius
his commen-
dation.

Columbus.

Eustachius.

Baehnius.
Archangelus.
Picholomineus.
V. Arantius.
Pigafeta.
Volc. Coeitur.
Platerus.

Guillemaeus.

Paracelsus.
Cabrolus.
Pinus.

Laurentius.
his commen-
dation.

Andreas Laurentius hath taken worthy paines, and sweat much in this Sand, to his great honor, and the generall good of the whole Schoole of Anatomists; for beside his descriptions, he hath handled learnedly the Controuersies of euery part, with great euidence of

D

argument,

Bauhine
diligence

Pauus

Iul. Casserius

Argument, wherein I beleue he hath satisfied himselfe and all the world beside. These his Controuersies we haue taken into our worke, yet not alwaies tying our selues to sweare what he sayes, but for the most part we find him in the right. His Descriptions we take vnder correction, not to be so perfect, and his Figures most imperfect. In those two *Bauhine* hath farre exceeded him and all Men else; to whom therefore we sticke the closer, although we could haue wished that *Bauhine* had had the care of his own Worke himselfe, and had not betruusted others with his credite, who haue in no few things fayled his expectation & ours. *Pauus* of *Leiden* is a great Anatomist but writes for his Inscription, *Posse & nolle nobile*. Surely he can doe much, & I would to God he could be ouercome, to communicate himselfe; some things we haue gathered from his own mouth, whereof it shall neuer repent vs. Finally, within these three or foure yeeres, *Iulius Casserius* the Anatomist of *Padua* in *Italy*, set forth an elegant Booke of the five Senses, wherein he hath laboured sufficiently, if not too much; for there is a kind of sobrietie to be vsed also in humane studies, beyond which to be wise, is not farre from folly. *Casserius* hath done many things excellently well, and of good vse, but his extraordinary diligence about the Organs of the Senses in so many Creatures, I see no cause to imitate; for sure I am, by that little experience I haue, that many of these nice & fine points, though they make a faire shew, and tickle the Eares of a Man when he reads them, and delight his Eye when he sees the resemblances of them printed before him; yet when he shall come to search for them in the Body of Man, they will not be so obuius, if they be at all; or if they be found, yet serue rather for a speculative pleasure and admiration, then be of any vse in the Art of Physicke or Chirurgie.

Among our selues *Gemini* was the first: In his Descriptions too brieue, in his Tables too confused, rather contenting himselfe with *Vesalius*, then giuing contentment vnto others: Yet for those times he is worthily to be commended. That good and ingenuous old Man *Banister*, was a true Patriot, he loued his Countrey and Learning, and spent himselfe in doing good, and his memorie is worthy to be registred euen for his Anatomy among the rest of his Labours. At this day we haue also some worthy to be named, who if they listed, could turne the gaze of the World West-ward, and time I hope will bring their Monuments to light. In the meane time, we haue aduentured to hold vp this Taper, at which if they please they may light their Torches.

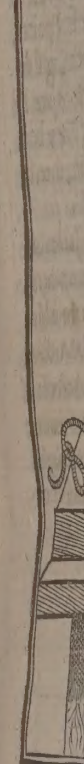
CHAP. XV.

Of the definition of Anatomy, and what Instruments are thereto necessarie.

The notation
of Anatomy.Anatomy
two-fold.Historicall.
Scientificall.A definition
of Anatomy.
Galen.What things
are required
in artificiall
Dissection.

ANATOMY is a Greeke word, and signifieth Section or Cutting. Hence comes *ἀνατομή*, a diligent and curious Section, vnderaken to get knowledge or skill by. For *ἀνατομή* is to cut with great diligence. Now there is amongst Physitians, a double acceptation or Anatomy; either it signifieth the action which is done with the Hand, or the habite of the Mind, that is, the most perfect action of the Intellect. The first is called Practicall Anatomie, the later Theoricall or Contemplatiue: The first is gained by experience, the second by reason & discourse: The first we attaine onely by Section and Inspection, the second by the liuing voice of a Teacher, or by their learned writings: The first we call Historical Anatomy, the second Scientificall: The first is altogether necessarie for the practise of Anatomy, the second is onely profitable; but yet this profite is oftentimes more beneficiall then the vse it selfe of Anatomy: The first looketh into the structure of the parts, the second into the causes of the structure, and the actions and vses there-from proceeding. According to the first signification we may define Anatomy thus: *An Artificiall Section of the outward and inward parts.* I call it *Artificiall*, to distinguish it from that which is rash & at aduenture, which *Galen* calleth *Vulnerarie Dissection*. For often-times in great wounds we obserue the Figure, Scituation, Magnitude & Structure of the outward and inward Parts; but that obseruation is but confused, for we cannot distinctly perceiue the branchings of the Nerues, the Serpentine and writhen Meanders of the Veines, nor the infinite diuarcations of the Arteries. Now that a Dissection may be made artificially, it is first requisite that the parts be so separated one from another, that they may all be preserued whole, not rent and torne asunder. Next, that those which grow not together, be gently diuided. Thirdly, that those which do grow together, be carefully separated. Fourthly, that we mistake not many parts ioyned together for one, nor yet make many parts of one. Now

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of Brasse, Sil
Needles be
blow vp the p
Trepans, Bal
together with
Rings, Chain



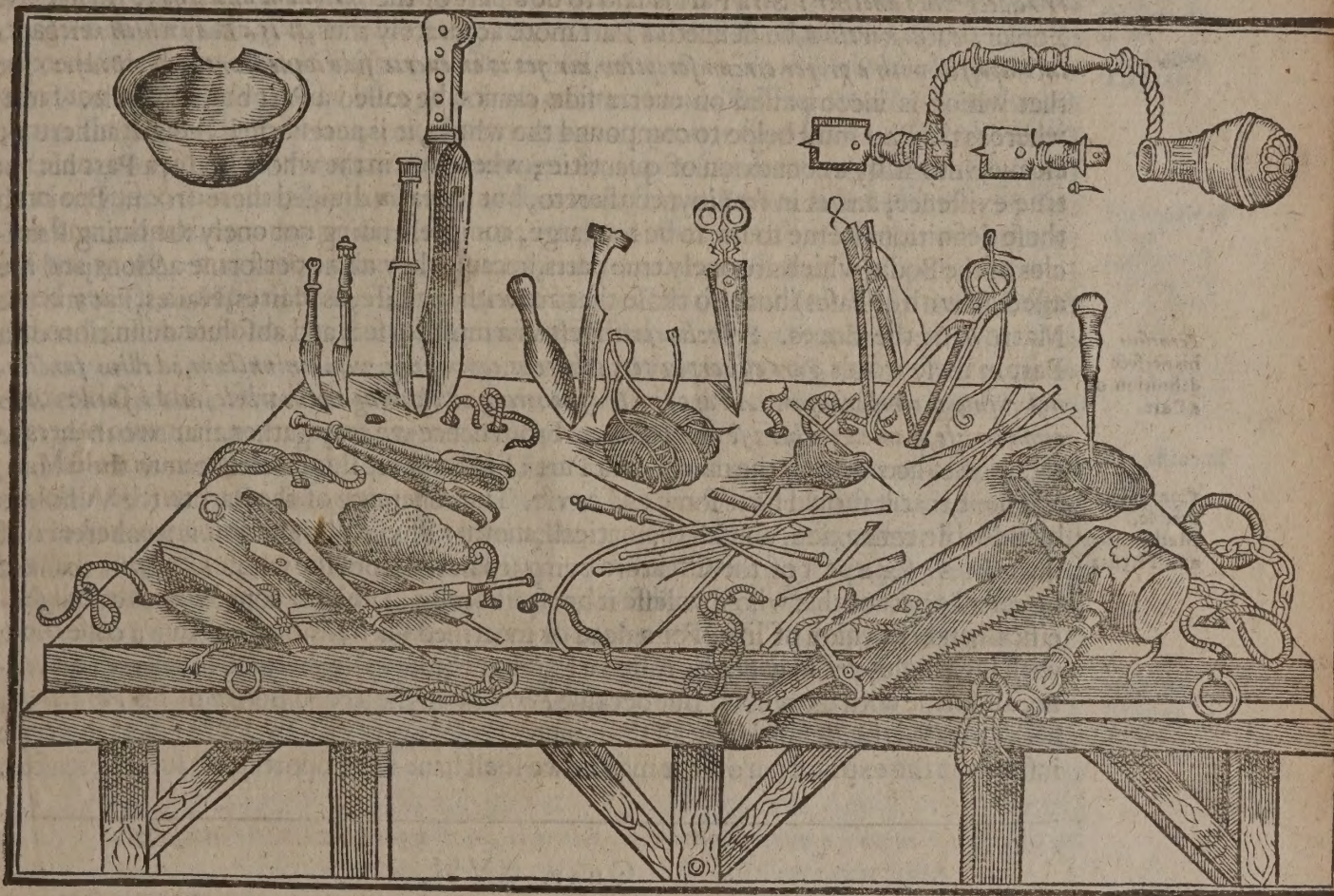
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Now this Section cannot artificially be accomplished, vnlesse the Ministers haue convenient Instruments, as are these; Razors of all sorts, great, small, meane, sharpe, blunt, straight, crooked and edged on both sides; Sheares or Sizers; round and long Probes of Brasse, Siluer, Lead; a Knife of Box or of Iuory; Pincers of all sorts; Hookes; Needles bent rather then straight; Reeds, Quils, Glasse-trunkes or hollow Bugles to blow vp the parts; Threds and Strings; Sawes, Bodkins, Augers, Mallets, Wimbles or Trepan, Basons and Sponges: The Figures of all which we haue here-vnder delineated, together with a Table whereon to lay the Dead, or bind the liuing Anatomy, with the Rings, Chaines, Cords and Perforations fit for that purpose.

The Instru-
ments of the
Anatomy



If Anatomy be taken in the latter signification, it is defined *A Science or Art, which searcheth out the Nature of euery part, and the causes of the same Nature.* I call it a *Science*, because it hath vniuersall or generall Theoremes or Maximes, and common Notions, out of which, being the *first, true, immediate and best knowne*, all demonstrations are framed. Vnder the name of *Nature*, I comprehend many things: The Substance, which is the habitation of the particular Facultie; The Temper, which is called the forme of the similar part; Those things which follow the Temper, as the Qualities, such as may be felt, hardnesse, softnesse, thightnesse or fastnesse, and raritie; thicknesse, thinnesse, saours or taits, and colors. Appurtinances also or Accidents, as the composition of the part, to which I referre the Magnitude, Number, Position, Figure, Continuitie and Scituation; and finally, the actions of the parts, and their vses.

Another
definition of
Anatomy.

CHAP. XVI.

what is the Subiect or immediate obiect of Anatomy, to wit, a Part, where the definition of a Part is unfolded.

THE Subiect of both kinds of Anatomy as well Historicall as Scientificall is a Part. For the Anatomist doth not handle a whole Body, but a Body diuided into Members and Parts; and therefore we must find out what is the nature of a Part and the differences of the same. A Particle, a Member, a Place, *μερος, μέρη, τόπος, μέρος*, signify

The names of
a Part.

Aristotle.

Theodorus.

The definition
of a part.Fernelius
his perfect
definition of
a Part.Connexion is
double,
Mathematical
and Physicall

signifie one and the same thing. *Aristotle* thought that the appellation of a Part did best agree to the similar particles, and of a Member to the Organically, and especially to those which were most compounded. *Theodorus* saith that the name of a Part or place hath a larger extent then that of a Member, because that onely is a Member which is organically, but all compound and simple particles are truly called Parts. We with *Hippocrates* and *Galen* make no difference betweene a Part, a Particle or a Place. *Galen* in the first Booke of his Method, defineth a Part to be *whatsoever doth integrate or accomplish the whole*. And in his first Booke *De Elementis*, *whatsoever maketh to the constitution or frame of Mans body*. For a Part is one of those things which the Logicians do call *τὰ μέρη*, that is, *have reference or respect vnto another*: So a Part is said to be a part of the *Integrum* and whole. In his first Booke *De Vsu Partium*, he defineth a Part more accurately thus, *It is a Body which neither is encompassed with a proper circumscription, nor yet is on euery side ioyned vnto other Bodies*: for that which is encompassed on euery side cannot be called a Part but a Whole. Now whereas the Part must helpe to compound the whole, it is necessarie it should adhere or cleave vnto it by a connexion of quantitie; wherefore in the whole Body, a Part hath a true existence, and is in deed ioyned thereto, but in reason diuided therefrom. But both these definitions seeme to me to be too large, comprehending not onely the liuing Particles of the Body (which are onely true parts, because they alone performe actions, and are affected with diseases) but also those that are without Life, as Haires, Nailes, Fat and the Marrow of the Bones. *Fernelius* hath left vs a most perfect and absolute definition of a Part in these words, *Pars est corpus toti coherens, communis, vita coniunctum, ad illius functiones usumq, comparatum*. A Part is a Body cohering or cleaving to the whole, and ioyned to it in common life, framed for his use and function. From hence we may gather, that two things are required to accomplish the nature of a Part: First, that it should cleave vnto the whole, and next, that it should haue some end or vse. The coherence of the Part to the Whole is by a double connexion, one Mathematicall, another Physicall: The first is a coherence of quantities; for a part of the Creature being separated from the whole Creature, cannot be called a part of that whole, vnlesse it be equiuocally. The later connexion is called specificall, and is a vnion of life: For a dead or mortified Part, although it haue a coherence with the whole, yet may not be called a Part but equiuocally, because it hath not an vniuocall forme with the whole. But because *Fernelius* in the second Booke of his *Physiologie*, hath canuased this definition & all the minutes thereof very exactly, I will not at this time insist vpon the explication of it, it may be we shall haue fitter oportunitie for it hereafter.

CHAP. XVII.

What an Anatomist must consider in euery Part.

Three things
are to be con-
sidered in a
Part.Structure
what it is.The substance
of a part
what it is.The temper
what it is.

Anatomists do obserue many things in euery part, which *Galen* in his Bookes *De Vsu Partium* referreth to nine Heads. We, the better to auoid confusion, lest the wits of those that are ignorant should be too much racked, will consider onely three things, to which all the rest may be referred, the *Structure*, the *Action* and the *Vse*. The word *Structure*, I take here in a large signification, as *Aristotle* and *Galen* haue often taken it; not onely for the conformation, but for whatsoeuer addeth or helpeth any thing to the constitution or composition of the Part. Now these three things goe to that constitution, the Substance, the Temper, and the Conformation. The Substance (as we said before) is the Mansion of the particular and determinate facultie, and is peculiar to euery part; and in that respect, the Substance of a Part is said to be bony, membranous, neruous, fleshy, medullous or marrowy. This Substance it hath partly from the Forme, partly from the Matter, and it is known by sensible qualities, such as are hardnesse, softnesse, thicknesse, thinnesse, raritie, densitie or thightnesse, colour and fauour or tast. The Temper accompanieth this Substance & hangeth vpon it, following the materiall qualities; for it is not a thing abstracted or separated, but hath a firme coherence with the Matter or Substance, as with her Subiect; and therefore the Physitians call the Temper, the Forme of the similar Parts, although indeed it be not so much; but onely *πρῶτον δεκτικόν*, that is, the immediate receiuer of the Soule. This Temper the Physitian especially standeth vpon; for euery Part worketh thus or thus, according to

and

and by his temper; and he that will maintaine the actions or functions of the Parts, must haue especiall care to preferue their true and genuine temper. In respect of this temper, the Parts are said to be hot, cold, moyst and dry; alwayes hauing a respect to a *medium*, that is, to a thing of a meane and middle temper, that is the Skin. A hot and a cold temper we distinguish rather by reason and discourse, then by sense, because in a liuing Creature there is nothing actually cold. But the moyst and dry temper sense onely discouereth, that is, the hardnesse or softnesse of the part; for whatsoeuer appeareth hard to him that toucheth it, that we resolute is dry, because in a liuing Creature there is nothing hard by concretion or curdling; whatsoeuer feeleth soft, is moyst. The conformation of a Part consisteth in the Symmetry, that is, the naturall proportion or constitution of many things, to wit, of the Figure, Magnitude, Number and Scituation. To the Figure we referre the Superficies or Surface, the Pores & the Cavities. To the Scituation we referre the Seat and position of the Part, as also his connexion with others; for the Parts doe not hang loose in the Body, or separated one from another, but they haue a coherence, being tyed together by Ligaments and Membranes. And therefore it behoueth a Physitian and Chirurgeon to know which parts are tied to which, that when one part is affected, he may know what parts may be drawne into sympathy and consent with it. To this conformation *Galen* referreth the beautie of the Part, which he conceiveth to reside in *ὁμοιότης*, that is, in the equality of the Particles; but we place the beautie of the whole Body, in the inequality of the Parts, that is, in their vnlike and different qualitie & magnitude; but yet such a difference as whereby the Parts doe answer one another in an apt and neat correspondencie of proportion, even as Musicke is made of different sounds, but yet all agreeing in a harmonious consent; and thus much of the Structure of a Part.

Next followeth the Action, which *Aristotle* calleth *The end of the Structure*; because for the Action sake, the Part hath his Substance, Temper & Conformation. So the Heart, because it was to be the Mansion and habitation of the Virall facultie, and the Store-house of Arteriall blood, hath giuen vnto it a fleshy and solid Substance, a Temper hot & moyst, a Figure somewhat long, but comming neere to the Sphericall, hollowed also with two Ventracles or Bosomes, and many obscure Cavities, in which the Household-Gods and Fire-harth of the Body were to remaine, from whence there should issue & spring a continuall supply of natieue heat and spirits. I define an Action with *Galen*, *A motion of the working Parts*, or *A motion of the Actor*, to distinguish it from an Affection; for an Affection is a passive motion, or a motion of a passive or suffering Body; but an Action is *Motus effectiuus*, an effectuating or working motion; so Pulsation is an Action of the Heart; Palpitation is an Affection or a passion; the first proceedeth from a Facultie, the second from a sickly or vnhealthfull cause, which we commonly call *Causa Morbifica*.

Of Actions some are common, some are proper; the common Actions are found euery where; the proper are performed by one particular Part. Nutrition is a common Action, for all liuing and animated Parts are nourished, because life is defined and limited by Nutrition. Proper Actions are performed by a particular Organ, and they are either principall, or such as minister to the principall. Againe, of Actions some are Similar, some Organicall. A Similar action is begun onely by the Temper, and by the same is perfected, and is performed by euery sound and perfect Particell of euery Part. The Organicall is not commenced by the Temper onely, neither is it accomplished by the Particles, but by the whole Organ or Instrument.

Finally and in the last place, the vse of the Part must be considered by the Anatomist; For the Philosopher saith, that we are led vnto the knowledge of the Organ, not by his Structure but by his Vse. The Vse which the *Gracians* call *χρῆσις*, is two-fold according to *Galen*. One followeth the Action, that is, ariseth from the Action it selfe, and is the end of it; as by the Action of Seeing, the Creature hath this Vse, that he can auoid that which is hurtfull, and pursue that which is behoofefull. This Vse, if you respect the Generation and constitution of the Part, is after the Action; but in dignitie and worth it is before it, because it is the end of all Actions: Now the End is more excellent then those things that appertaine or lead vnto that End. The other Vse goeth before the Action, and is defined to be *A certaine aptitude or fitnessse to doe or worke*. So in the Eye the Christalline humor doth primarily make the Sight; the other humors, the Coates, the Optick-nerues afford a Vse, and are ordained to perfect the Action of Seeing. This Vse is in dignitie behind the Action, but in generation before it: By which it is manifest that the Action differeth,

The conformation what it is.
The Figure.
The Scite.

The beautie of a Part

Galen, and *W*

The action of a Part.
Aristotle

What action is.
Galen

The differences of actions

The vse of a Part

Aristotle.

The vse is double.

Galen.

and is another thing from the Use, although many Men use to confound them. For the Action is an active motion of the Part, but the Use an aptitude for Action. The Action is onely in operation, the Use remaineth also in the rest or peace of the Member: the Action in euery Organ is onely the worke of the principall Similar part in that Organ, the Use is likewise of all the rest. To conclude, there are many parts which haue Use without any Action, as the Haires and the Naailes.

CHAP. XVIII.

The differences of Parts: And first, HIPPOCRATES his diuision of Parts.



HE diuision of the diuine Senior, in his sixth Booke *Epidemion*, is of all other the most ancient, into *ἰσχυρά, ἰσχυρὰ καὶ ὀρμῶντα*, that is, *Containers, contained and those that are impetuous*: To use the Martialists word, doe make impression. Alexander more plainly diuideth the Body into *σῆμα, ὕγρὰ καὶ πνευματώδη*, that is, *Solid, Humid and Spirituous parts*. We diuide them into Parts nourishing, to be nourished and impulsue Parts. The containing Parts are solid, and such as are to be nourished. The name of solid I doe not take as the common People doe, for that which is hard and tight, or dense; nor for that which is contrarie to rare and hollow, but with the best Philosophers, by solid I vnderstand that which is *ἰσχυρὰ τὰ τε*, that is, which is wholly full of it selfe not of any other thing, or which hath a nature euery way like vnto it selfe. For *Solum* and *Solidum* in Latine, doe come of the Greeke word *δαῖον*, by changing the Aspiration into a hissing, and so is set before *δαῖον*: And thus the fleshy Parts also may be called solid and containing Parts. So the Heart a fleshy Entraile, containeth in his right ventricle Venall, in his left arteriall Blood. So the marowy substance of the Braine, which hath in it many dens and caviities, containeth both humors and spirits. We call also all solid Parts, Parts to be nourished, because whatsoever is solid, the same is similar, and the action of a similar Part is Nutrition.

Contained Parts are the humors concluded or shut vp in their proper Vessels and Conceptacles, as it were in Store-houses. Galen calleth *τὰ ὄργανα*, that is, humors, *τὰ ἐν τοῖς ἀγέστοις ἐμπεριόμενα καὶ κατὰ πᾶν σῶμα διασπαρμένα*, that is, such as are contained in the Vessels, and dispersed through the whole Body. Some had rather call them *ἰσχυρὰ*, *Things detained*, the better to signifie those things which are contained within vs, as also which doe preserve the substance of the Part: And therefore we haue called them Nourishers, to restrain the word *Humors* to the Alimentarie, and not to include the Excrementitious.

ὀρμῶντα or *ἰσχυρὰ*, that is, impulsue or impetuous things, *Fernelius* referreth to the faculties of the Soule; not to the Spirits; but in my opinion he is in this out of the way. For though the Spirits be contained, and haue proper conceptacles, to wit, the Veines, Arteries & Nerues, yet they are truly called impulsue substances; and *Hippocrates* spake of the Body & bodily things, and therefore not of the Faculties, which are but abstracted Notions. Now by the word Spirit, I do not vnderstand a wind, for these are *ἀνδροειδέα*, *Bastard*, or as *Anicen* termeth them *Fraudulent spirits*, whose violence is sometimes so great and furious, that they are the cause of many tumults in the household government or naturall constitution of the Body, which is often-times miserably distressed with their furious gusts: Read what *Hippocrates* in his Booke *De Flatibus* hath written of the power of Winds. But by Spirits we vnderstand the primarie and immediate Instrument of the Soule, which the Stoicks calleth the *Band which tyeth the Soule and the Body*. The force of these Spirits is such, and so great the subtiltie and thinnesse of their Nature, that they can passe suddenly through all parts, and doe insinuate themselves through the fastest and thickest substances, as we may perceiue in the passions of the mind, in sleepe and in long watchings. By the ministerie of these Spirits, all the motions of liuing Creatures are accomplished, both Naturall, Vitall and Animall, and by these, life, nourishment, motion and sense, doe flow into all the parts. Finally, the motion of the Spirits is perpetuall, both of themselves, and by another. By themselves, that is, they are moued continually from an inbred principle both wayes, vpward and downward; vpward because they are light, downward toward their nourishment. They are moued by another when they are driuen and when they are drawne. The Vitall Spirits are driuen, when the Heart is contracted, the

Animall

The confor-
mation of the
parts of the
body, and the
conformity of
the parts of the
body to the
parts of the
body.

What are
containing
Parts.

What are
contained
Parts.

Impetuous or
impulsue
things as the
Spirits.

Hippocrates

Anicen.

Hippocrates

The continual
motion of the
Spirits.
Their motion
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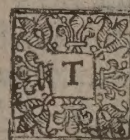
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Animall when the Braine is compressed. The Spirits therefore are *εὐκίνητοι* impetuous substances. They are fiery and ayery, and therefore very fine, subtle and swift: So the Seed although it be thick & viscid, yet in a moment it passeth through the vessels of Generation, which haue no conspicuous cauities, and that because it is spirituous, or full of Spirits.

There are also other differences of Parts, according to *Hippocrates* in his Booke *De Veneri Medicina*, which are drawne from their Substance, Figure and Scituation. From the Substance, some are dense, others rare and succulent, or iuicie; others spongie and soft. From the Figure, some are hollow, and from a largenesse gathered into a narrownesse or constraint, others are stretched wide; others solid and round, others broad and hanging, others extended, others long. From the Scituation, some are anterior, some posterior, some deepe, others middle, vppermost, lowermost, on the right hand and on the left.

CHAP. XIX.

A diuision of Parts into Principall and not Principall.



THE diuision of Parts into principall and lesse principall, is verie famous, and hath held the Stage now a long time. We define, that to be a principall Part, which is absolutely necessarie for the preseruacion of the *Individuum* or particular Creature: Or, which affordeth to the whole Body, a facultie, or at least a common matter. In both Senses, there are onely three principall Parts, the Braine, the Heart and the Liuer; the Braine sitteth aloft in the highest place, as in the Tribunal or Iudgment-seat, distributing to euerie one of the Instruments of the Senses, their offices of dignitie. The Heart (like a King) is placed in the midst of the Chest, and with his vitall heat, doth cherish, maintaine and conserue the life and safetie of all the Parts. The Liuer, the Fountaine of beneficall humor, like a bountifull and liberall Prince at his proper charges, nourisheth the whole Family of the Body. From the Braine, the Animall facultie by the Nerues as it were, along certaine Chords, glideth into the whole frame of Nature. From the Heart, the Vitall spirits are conueyed through the Arteries, as through Pipes and Water-courses into euerie Part. From the Liuer, if not a Facultie, yet a Spirit; if not a Spirit, yet at least a common matter, to wit, the Blood is diffused by the Veines into euerie corner. So that onely three are absolutely necessarie for the conseruation of the whole *Individuum*, the Braine, the Heart and the Liuer, all which are fitted and tyed together in so strait a conspiracie, that each needeth the helpe of the other; and if one of them faile, the rest perish together with it. Not that I thinke these parts are of equall dignitie, for the Heart is more noble then the Liuer, and the Braine more excellent then the Heart, as well because his actions are more diuine, being the Seat and Palace of Reason, which is the Soule; as also, because all other parts are but Hand-maids vnto it: And besides, *Hippocrates* saith, it giueth the forme to the whole Body, *For (saith he) the Figure of the rest of the Bones, dependeth vpon the magnitude of the Braine, and the Skull.*

Galen addeth to the principall Parts, the Testicles, because they are the chiefe Organs of Procreation, by which alone, the species or kind is preserued. But we thinke that they conferre nothing to the conseruation of the *Individuum* or particular Creature, because they neuer afford any matter to the whole Body, neither Facultie or Spirit, but onely a Qualitie, with a subtle and thin breath, from whence the Flesh hath a seedy rammishnes, a harsh tast and strong sauour, and the actions strength and validitie. All the rest of the parts may be called ignoble compared to these, as well because from them proceedeth no Facultie, Spirit or common matter, as also because euerie one of them, doe minister to some one or other of the principall Parts. So the Organs of the Senses serue the Braine, and were created for his vse and behoofe: So the Lungs, the Midriffe and the Arteries, as well smooth as rough, were ordained onely for the tempering and repurgation of the Heart: So the Stomach, the Guts, the Spleene, both the Bladders of Vrine and of Gall, were made for the Liuer: And in a word, none of these ignoble parts are of necessitie for the conseruation of the Creature, or if they be necessarie, it is not *ἀπλῶς*, that is, simply and absolutely, but *secundum quid*, that is, as they are necessarie to serue the turne of the principall. For I pray you, what vse hath the Arme, the Legge or the Stomach of the Lungs, the Spleene and the Kidneys? Againe, what necessarie vse haue the Lungs, the Spleene and

Differences of Parts according to Hippocrates

What is a principall Part.

Three principall Parts.

The Braine more excellent then the Heart.

Hippocrates

Galen How the Testicles may be called principall Parts. What parts are called ignoble and why.

The differen-
ces of the
ignoble parts.
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and the Kidneys of the Legges or Armes? But to all these the Heart giueth Life; the Liuer Nourishment, and the Braine Sense and Motion, so that the Braine, the Heart, and the Liuer are in all the parts of the Body, by the mediation of their Vessels. Now, as there is not an equalitie of dignitie among the principall Parts, so the ignoble Parts are not all of one and the same degree. For some of them serue the principall by preparing some-what for them, others by carrying or leading some-what vnto them. There are also some ordained onely for the expurgation or cleansing of the principall, which are the most ignoble of all the rest, and are commonly called Emunctories or Drayners. So for the Liuer the Stomach boyleth the Meat, the Veines of the Mesenterie giue the Blood a kind of rudiment or initiation; the Caue or hollow Veine disperseth the Blood already perfected. For the Heart the Lungs prepare the Ayre, the Pipes of the great Arterie carrie about the Vitall spirits. For the Braine the wonderfull texture or plighted web of Vessels prepares the Animall spirit, and the Nerues distribute it into the whole Body. Behind the Eares are the Emunctories or Drayners of the Braine; vnder the Arme-holes so many Glandules or Kernels which receiue the superfluites of the Heart, and in the Leske or Groyne are the Emunctories of the Liuer.

CHAP. XX.

A diuision of Parts into Similar and Dissimilar, and an interpretation of the same.

All the names
of the similar
Parts.
Plato.
Aristotle.



THE most frequent diuision of the Parts among Philosophers and Physitians, is into Similar and Dissimilar, which is also the most necessarie for the exquisite disquisition and distinction of Diseases. The Similar parts, Plato first called *πρωτόγωνα*, that is, *First borne*, because according to the order of Generation, they are after a sort before the compound Parts; and because they are the first *Stamina*, Threds or Warp of the Body. Aristotle calleth them *ἀπλά καὶ ἀσύνθετα μέρη*, that is, *Simple and uncompounded Parts*, because they are not compounded of other parts, or else *πρὸς τι*, that is, *in respect of the compounded*: For they are not in deed and truly simple, for the Body of the Creature being not simple; neither can the parts of it be truly simple.

Anaxagoras.
Aristotle.

First *Anaxagoras*, and after him *Aristotle* brought in the name *τῆς ομοιογενείας*, of *similitude*, whence they are called Similar, because they haue one & a like substance. Some call them *πρὸς ἑαυτὴν μέρη*, that is, *Continuall Parts*, because they are continually the same both in matter and forme. Others call them *Informes*, without *Forme*, but we thinke it better to call them *Vniforme parts*. Aristotle called them *Sensorias*, because that which is Similar is capable of sensible objects, and all sense originally proceedeth from the Similar parts. *Galen* calleth them some-times *Sensible Elements*, because they appeare to the Senses most simple and vncompounded; some times *ἐλάχισα κομμάτια*, that is, *The least Particles*. Some-times the *First*, sometimes the *Last bodyes*; *First*, in respect of their composition; *Last*, because into these the Body is dissolued as into the least parts that may be distinguished by the perceiuing Senses. Some call them *Solid*, not because they are constant, euer consisting and neuer diffuent (for then the Flesh should be no Similar part) but because they are euerie way full and compleate. The common people call that Solid, which is hard, dense or compacted; for Water or a Sponge, they will neuer acknowledge to be Solid: But the Philosopher calleth that Solid, which is wholly full of it selfe, and of no other thing, which is of a like or of the same nature; so the Fire in his owne Globe, and the Heauen (although they be most rare and subtile Bodyes) yet true Philosophers will call them Solid bodyes. *Hippocrates* calleth them *ἰσχυρὰ*, that is, *Containing Parts*: But enough of the name, now let vs come to the Essence of the Similar parts.

Aristotle.
Galen.

What is a
solid part.

Hippocrates

A similar part
hath a double
consideration.
A definition
of a similar
part.
Aristotle.
Galen.

A Similar part may haue a double consideration, one in respect of the Matter, another in respect of the Forme: If you regard the Matter, which is altogether one and the same, in all parts like vnto it selfe; then shall Similar parts be defined according to *Aristotle*, *ὅσα διαφέρουσιν αἰς ὁμοιογενείαν*, which are divided into parts like vnto themselves. According to *Galen*, *All whose Particles are like to themselves and to the whole*: Or, *Which are divided into parts not differing specie, or in kind*. If you respect the Forme of the Similar parts, then they shall be defined, *Such as haue an vniforme Figure*. For, because the Forme giueth the proper denomination to euerie thing, that shall be called *Similar*, which hath a similitude

or

or likenesse of Forme and Figure. In the first consideration or respect, euerie Particell of the Similar part retaineth the name of the whole, but not in the latter: So the Bone of the Legge because of the similitude of the Matter is vniforme, but if you respect his Figure, then are not all his parts of the same nature, for euerie little Particell of that Bone is not hollow, though the whole Bone be hollow. Hence we may gather that euerie Similar part may be said to be Organicall, and that they doe not well who oppose Similar and Organicall parts for *diuiding members*, as we say in Schooles: For among Philosophers, the nature of the part & of the whole is the same. The whole Body is Organicall, because *The Soule is an act of an Organicall body.*

Euerie similar part may be said to be organicall. *Membra diuidentia*

The Essence of the Similar parts seemeth to consist of an vncertaine medley of the Elements, and a temper of the foure first qualities, Heat, Cold, Moisture and Drought. And therefore the Physitians say, the Temper is the Forme of the Similar parts, because it is *πρῶτον δεκτικόν*, *The first receiver*, and the first power with which & by which, the Forme worketh; and the Similar part, as it is Similar, suffereth whatsoeuer the Forme worketh. So Nutrition, which is the common action of the Similar parts, is inchoated or begun by the Temper alone, by it is perfected, and plenarily and perfectly accomplished by euerie Particell of the Part.

The Essence.

The differences of the Similar parts, are some of them belonging to the Philosopher, some to the Physitian. The Philosopher rayseth his differences from the first qualities, and those which follow the Temper. The Physitian from the sensible and materiall principles of Generation. The first qualities are indeed foure, but because Heat and Cold are certaine acts, and an act is according to it selfe indiuisible, therefore the Philosopher rayseth his differences onely from the diuersitie of Drought and Moisture. Wherefore *Aristotle* maketh Similar parts, some dry, some moist. The moist are either properly so called, that is, such as of their owne nature cannot containe themselves within their owne *termini* or limits, and therefore do stand in need of conceptacles or receptacles, as the Blood; or else are soft, which doe better containe themselves within their bounds, as Flesh. The dry are those whose Superficies or Surface if pressed, yeeldeth either not at all, or verie hardly: And such he calleth *σπῆλαια*, or *σπῆλαια μέρη*, that is, *Solid parts*; of which he maketh two kinds. Some are fragile or brittle, which cannot be bent without the dissolution of the part, as Bones; others, are tough or stretching, which may be bent and extended without dissolution, as Ligaments and Membranes.

The differences of similar parts.

A Philosophicall diuision of them into moist and dry. *Aristotle.*

The Physitians doe gather the differences of Similar parts, from the sensible and materiall Principles of Generation. There are two materiall Principles, the Crassament or substance of the Seed (for onely the Spirits or the Workmen) and Blood: and therefore some parts are spermatieall, and some fleshy. The first are immediately generated out of the Crassament of the Seed, the latter of Blood: The first in growne and old Men, doe hardly reunite *κατὰ πρῶτον σκοπόν*, *according to the first intention*, as we vse to speake, because of the weakenesse of the efficient (for they are cold;) because of the vnapt disposition of the Matter, whose affluence is no confluence, that is, it floweth not together-ward and *ἀθροῖται*, *at once*; and because it must passe through many and diuerse alterations; add hereto the siccitie and hardnesse of the parts; for dry things doe not easily admit a vnion or consolidation, and the Philosopher in all mixtion requireth a waterie moisture, that by it as by Glue, all parts may be vnited. On the contrarie, fleshy parts, because they are hotter, softer and nourished with Blood, little or nothing at all altered, do presently re-vnite and close together, sometimes without any meane immediately; sometimes *per medium homogeneum*, that is, by a thing of the same kind.

The Physitians diuision of them into spermatieall and fleshy

There are diuers differences of spermatieall and fleshy parts. For the Seed, though it seeme to be similar, vniforme & euerie-where like it selfe, yet hath it parts of a different nature, some thicker, some thinner, some fat, some slimy, some fit for stretching, others for concretion or to be gathered together. Whilst therefore the procreating vertue worketh vpon that part of the Seed which can extend it selfe, it maketh Membranes, Veines, Arteries and Nerves; when vpon that which is fitter for concretion, it formeth Bones & Gristles; when the fat is more then the glutinous matter, then are Bones & Gristles formed.

The differences of spermatieall parts.

Againe, *Galen* obserueth in the spermatieall parts, a double substance, that which is truly solid, and that which is fleshy; the first may be moistned, but not restored; the other is as it were a concrete or congeled liquor, cleauing to the solid Fibres. There are three kinds of fleshy parts, three sorts of flesh. One *Flesh* properly so called, to wit, that of the

Galen. In spermatieall parts there is a double substance. Three sorts of flesh.

the

Hippocrates

the Muscles, which therefore *Hippocrates* calleth absolutely *σάρκα*, that is, *Flesh*. There is another *Flesh* of the Bowels or inward parts, which we call *Enterals* and *παρίχυμα*, as it were an affusion or confluence of Blood. There is also another *Flesh* of the particular parts.

A third diuision of the similar parts.

We will adde a third diuision of Similar parts, into Common and Proper. I call those Common, which make and constitute many parts of an vnlike and different nature, as the Bones, Gristles, Ligaments, Membranes, *Flesh*, Nerues, Veines and Arteries. Of which, the first five are truly Similar, the others onely according to sense: For the inner substance of a Nerue is Medullous, the outward Membranous. I call those Proper, which doe make the substance onely of one part, and such as is not found else-where; such are the marrowy substance of the Braine, the cristalline and glassie humors of the eye. Of all Similar parts there is a double necessitie: One, that of them Dissimilar parts may be compounded; the other I find in *Auerrhoes*, that they may be the Seat of the Sensatiue vertues, for all sense commeth by the Similar parts.

The necessitie and vse of similar parts. *Auerrhoes*.

What is a dissimilar part.

To the Similar part, we oppose the Dissimilar; for as the Similar part is, or may be diuided into Particles of a like, so Dissimilar into Particles of an vnlike or different kind: As the Particles of the Similar part retaine the name of the whole, so the Particles of Dissimilar parts haue no names at all. Wherefore we define Dissimilar parts to be, *Such as are diuided into parts of a different nature and diuers kind*. These the Physitians κατ' ἐξοχήν, by way of excellence doe call Organically, because their action is more perfect and euident, as also because the neatnesse of the Figure, the Magnitude, Number & Scituation (which foure accomplish the nature of an Organ) do more plainly appeare in compounded parts then in simple; so that both in respect of the Forme and of the Actions, they are more properly called the Organs of the Soule; for the Forme of the Similar parts is the Temper, of the Dissimilar a laudable conformation: Now conformation doth better answer the functions of the Soule, then doth the Temper, because the Soule is defined to be *An act of an Organically body*. The Action of the Similar is naturall, to wit, Nutrition, as being manifest euen in Plants; the Action of the Dissimilar part is animall, and therefore that is said to be the Action of Nature, this of the Soule. Furthermore, I define an Organ (with the Ancients) to be a part of the Creature which can performe a perfect Action; by perfect I vnderstand proper: For the Action of the Similar parts is common, not proper. *Galen* maketh foure orders of Organs or Instruments: The first is such as are most simple, which consist onely of Similar, as the Muscles. The second are those that are composed of the first, as Fingers. The third are such as are made of the second, as the Hand. The fourth are such as are made of the third, as the Arme. Againe, In euerie perfect Organ we may obserue foure kinds of parts; The first is of those by which the Action is originally performed; where these are, there is also the Facultie; and therefore they are said to be the principall parts of the Organ; such is the cristalline humor in the Eye, for it onely is altered by colours, and receiue the Images of visible things. The second kind is of those without which the Action is not performed, and these doe not respect the Action primarily and of themselves, but the necessitie of the Action; such are in the Eye, the Opticke nerue, the Glassie humor and the albuginious, which is like the white of an Egge. The third kind is of those by which the Action is better performed; and these respect the perfection of the Action, and therefore are called *Helpers*, such are in the Eye, the Coates and the Muscles, which moue & turne the Eyes with a wonderfull volubility. The last kind is of those parts which doe conserue or preserue the Action; these are the causes that all the rest doe worke safely; and they respect the Action, not as it is an Action simply, but as it is to continue and indure; such in the Eyes, are the Browes, Lids and Orb of the Eye; and this is the nature of Dissimilar and Organically parts. But that we might not passe ouer any thing, we will adde this one for a complement; That of Dissimilar parts, some are such by the first Institution of Nature, as the Hands and the Feet, from which if you take all the Similar parts, you shall reduce them into nothing; others are Dissimilar secondarily, because of the implications and textures of Veines, Arteries and Sinewes in them, as the Heart, the Braine and the Liuer; for if you take from the Braine the common Similar parts, yet there will remaine the proper substance of the Braine.

The dissimilar parts are rather the Instruments of the Soule then the similar.

What an Organ is.

Foure orders of Organs.

In a perfect Organ there are foure kinds of parts

Per se.

Another diuision of dissimilar parts.

CHAP. XXI.

The other differences of the Parts are unfolded.



Here are also other differences of Parts not so necessarie for a Chirurgion to know, which notwithstanding because we would leaue nothing behind vs, we will briefly declare. *Galen* in his Booke *De Arte Parua*, maketh foure differences of Parts: Some Parts are principall, as the Braine, the Heart, the Liuer and the Testicles. Some doe arise from these principall and minister vnto them, as Nerues, Veines, Arteries and Seed-vessels; some neither gouerne others, nor are gouerned of others, but haue onely inbred Faculties, as Bones, Gristles, Ligaments, Membranes. Finally, some parts haue vertues both *inbred* and *influent*, as the Organs of Sense and motion. The *Arabians* gather the diuisions of Parts, from the Substance, the Temper, those things which follow the Temper, and those things which are accidentarie or happen to the Part: Whence some parts are fleshy, some spermaticall; some hot, others cold; some moist, others dry; some soft, others hard; some moueable, others immoueable; finally, some sensible, others insensible. Those which haue sense, haue it either sharpe and quicke, or stupid and dull. A Part is said to haue exquisite sense three wayes, either because of the perfection of the sense, so the skin which couereth the palme of the Hand, and especially the Fingers ends, hath an exact perception of the tractable or touchable Qualities; or because it is more easily and sooner violated and offended by the internall and externall Qualities which strike the Sense; so the eye is said to be of verie acute and quicke sense, or because it hath a determinate or particular sense, which nowhere else is to be found; so the mouth of the Stomach is of most exquisite sense, that it might apprehend and feeie the exhaustion or emptinesse, and the suction or appetite of the other Parts: So also the Parts of Generation in both Sexes, haue in them a strange and strong desire and longing after their proper satisfaction.

The Anatomists commonly doe diuide the whole Body into the Head, the Chest, the lower Belly & the ioynts. The *Egyptians* into the Head, the Necke, the Chest, the Hands and the Feet. *Diocles* into the Head, the Chest, the Belly and the Bladder. *Fernelius* in the second Booke of his Method, diuideth the Body into publike and priuate Regions: And truly as I thinke verie commodiously for a practising Physitian or Chirurgion. The publike Region is three-fold: One, and properly the first, reacheth from the Gullet into the middle part of the Liuer; in which, are the stomach, the Meseraicke veines, the hollow part of the Liuer, the Spleene, and the *Pancreas* or Sweet-bread betweene them. The second runneth from the midst of the Liuer, into the small and hairie Veines of the particular parts, comprehending the Gibbous or bounding part of the Liuer, all the hollow Veine, the great Arterie that accompanieth it, & whatsoeuer portion of them is between the Arme-holes and the Groyn. The third Region comprehendeth the Muscles, Membranes, Bones, and in a word, all the *Moles* or Mountenance of the Body. There are also many priuate Regions, which haue their proper superfluities, and peculiar passages for their expurgation.

And thus me thinkes I haue run through the nature of Man, the Excellencie, Profite, Necessitie and Method of Anatomie, who haue written thereof as well in old times, as of later yeere, and among our selues; the definitions and diuisions of Anatomie,

the Subiect or proper Obiect of the same, the nature of a Part, with the differences and distributions of the same: It remaineth now,

that we vntie such knots as might in this entrance intrangle vs, and so hinder our progresse to that wished end which we set before

vs.

Galen maketh foure differences of Parts.

How the *Arabians* distinguish the Parts.

The *Egyptians* diuision of the Body. *Diocles*. *Fernelius* his excellent diuision of the Body.



A
Dilucidation or Exposition of the
Controuersies concerning the Subiect
of ANATOMIE.

The Preface.



IN the knowledge of Diuine Myserie, Implicit Faith is the High-way to Perdition, so in Humane Learning, nothing giues a greater checke to the progresse of an Art, then to beleue it is already perfected and consummated by those which went before vs; and therefore to rest our selues in their determinations. For if the ancient Philosophers and Artists had contented themselues to walke onely in the Tracke of their Predecessors, and had limited their noble wits within other Mens bounds, the Father had neuer brought forth the Daughter, neuer had Time brought Truth to light, which vpon the fall of Adam was chayned in the deepe Abyss. There is, as of the World and gouernment thereof, so of Arts a frame, the matter whereof comes downe from Heauen, but is gathered here by discourse of reason and experience. The beautie and glorie of whose Columns were not perfected in one Age, but the Ground worke was first layd in the times which were neerest to the originall of Nature; afterward addition was continually made by the vigor of the Soule of Man, and shall be vnto the end of the World. It were not hard to giue instances hereof in all Arts, nor haply would it be verie tedious; but it shall be sufficient (to auoyd prolixitie) to insist a little vpon generalls, and so descend vnto our owne Art we haue in hand. The first Man (saith the Diuine Storie) saw all the Creatures, and gaue them names according to their Natures, but that Sunne-shine was soonē clouded, that Image defaced, that Stampe battered by his fall. Afterwards, as a Merchant that had lost all his Inheritance in one Bortome, he was to begin the World anew, and to gather an estate or stocke of knowledge, by the trauell and industry of his Soule and Body; yet was not his Soule *Abrasa Tabula*, A playned Table, there remained some Lineaments which the Scripture calleth, *The Law of Nature*; not such as could exhibit any sufficient originall knowledge, but such as whereby, hauing gotten knowledge from without himselfe, might make him againe acknowledge the darke and defaced Foot-steps that remained in himselfe, and to polish and refresh them somewhat, though it was impossible to reduce them to the former perfection. Thus the Soule by discourse of Reason, that is, by her owne act, knew her naturall immortalitie, and by induction of particulars, came to informe her selfe of the Natures of other things: Not as she knew before, from the vniuersall to particulars, but by gathering particulars together to frame generall and vniuersall notions.

And surely in the first Age, by reason of their long life, and consequently of their infinite obseruations, haply also because they were neerer to integritie of Nature, the Defection

tion not being so suddenly confirmed, Men layd the grounds of Arts, which were deli-
 uered by Tradition from the first Fathers simply and faithfully; but afterward by enue
 or corruption were wrapped vp in mystical Hieroglyphicks, or poysoned with Supersti-
 tion, or forfeited by Negligence, many of them also were worne out by length of Time,
 for want of Letters and meanes to performe them. Those which remained, ran in Fami-
 lies, and from Families were deuolued vnto Nations as the World encreased: First, as is
 supposed, to the *Chaldeans*, then to the *Phenicians*, after to the *Egyptians*; all which, as the
 Nature of Man is prone to worke vpon that, it can least attaine vnto; or else, because the
 Diuinitie of the Soule finding no contentment in that she conceiued to be lesse then her
 selfe, did therefore neglect all sublunarie things, and applyed it selfe to speculations of
 Heauen and heauenly Bodyes, wherein Men were furthered by that old and cunning Ser-
 pent, who put to his helping hand to seduce them from the acknowledgment of their own
 imperfection, by goading them forward in an addle and vaine disposition of friuolous
 and impious secrets. So the Tradition of God, as being of too high a pitch for their im-
 ped wings, was peruered vnto an vnknowne *Numen*. The Tradition of Angels into feig-
 ned Spirits, gouerning the motions of the Heauens. That of the true vse of the Starres
 into Iudiciall and Genethliacall Astrologie. That of the fall of *Adam* and *Eue* into the
 Fable of *Isis* and *Osiris*. The Deluge into *Deucalions* Flood. The Diuinitie of the Mind
 and Soule into the Tale of *Mitris* and *Ariminis*, and a world of such superstitions Toyes.
 And verily almost all such was the learning of the former Ages, till the *Gracians* fell vpon
 the grounds of Demonstrations: And then Men first began to fall from those abstruse
 and transcendent contemplations, and to bring home Philosophy vnto themselues. Their
 Metaphysickes were Logically, their Physickes Elementarie; the Diuinitie of the Soule
 was tyed to the Principles of Generation, and supposed to result out of the power of the
 matter of the Body: And in a word, Philosophy fell from Heauen into the Elements,
 wherein they so accombred themselues, and those that followed them, that to this day we
 are scarce vninthrallled from them. Yet there wanted not some, who labored in all kinds,
 to bring Learning to better thrift: *Homer*, *Hippocrates*, *Plato*, all of them in their kinds, the
 verie Oracles of Philosophy, so as we may truly say, that whatsoeuer we haue solide and
 substantiall, it is but deriued from their Fountaines.

Neither were these Men onely happy in their owne sublime and diuine wits and ap-
 prehensions, but also in their Interpreters, *Virgil* to *Homer*, *Aristotle* to *Plato*, and *Galen* to
Hippocrates. The former two we let passe, as belonging to another *Forum*, *Hippocrates* as the
 first head of our Tribe, the Father and Founder of the Family of Physitians, left a goodly
 Inheritance to his Posteritie, which *Galen* (to passe by the rest) hath not mispent but much
 improued, and we who are *Artis Filij* may worthily be accounted Decoctors & Prodigals
 if we keepe not our Patrimonie together; nay, in this kind of Thrift, not to goe forward
 is to goe backward. Yet I must confesse, that after *Galen*'s time, and his Epitomizer *Oriba-
 sius*, who liued but in the next Age, Anatomy (for that is the end we driue at) lay raked vp
Patrio in puluere, till within some of our Memories. *Vesalius* albeit some-what importu-
 nately, yet verie learnedly, blew vp the all-most dead sparkes into a most luculent flame,
 at whose Beacon, all since his time haue teened their Torches, though haply being put to-
 gether, they may seeme to dim his Light by their multitude.

There is, and will alwayes be left *Locus Philosophandi*, scope enough, euen in this Little
 world for such as list to exercise themselues; and many haue with no small commendati-
 ons made prooffe of their agilitie, yet we must needs acknowledge, that the Ground-work
 of the Building, and not onely so, but the whole Frame was by the Ancients, reared vp;
 and therefore now if any Ornaments be added, they must be fitted thereunto. Wherefore
 we haue labored to bring all the subtleties and nouell inuentions of the later Writers, to
 the Touch-stone of the ancients Monuments; that as no Man should be defrauded of his
 due commendation; so the Crowne may remaine, where with so much dust and sweat it
 was gloriously merited; whereby we doe not desire to be accounted amongst the number
 of the Antagonists, but as a Herald of Honour, doe endeauor to Marshall the Field, and
 sometimes where the case is cleere, to ioyne in vmpeirment with the Spectators; or
 where it is difficult to assist them.

QUEST. I.

Of the definition of a Part.

Hippocrates
the Oracle of
Physicke.
Galen his
interpreter.
Words
synonymal.



Hippocrates

Aristotle.

Theodorus.
Galen.

Auicenna
definition of
a Part in pe-
fect. *Fen pri-
ma primi.*
Dof. 5. cap. 1.

Galen

An excuse of
Auicenna
but which
will not hold
water.

Aponensis
definition of
a Part.

Galen's two
definitions.

Both too
large.

Fernelius
the French
Galen.
Argenterius
his caill at
Fernelius

Hippocrates, whose happy workes are the verie Oracles of our Art, and Galen his Interpreter, doe promiscuously vse the names of a Part, a Member and a Place, for the same thing. The Eye (saith Galen in the first Booke of his Method) we call a Member; neither is there any oddes which you call it, a Member, or a Part: If any Man shall say the Eye is a Part and not a Member, or a Member and not a Part; I will not in either contend with him. In his first Booke De Locis Affectis; Not onely the later Physitians (saith he) but many also of the ancients doe vse to call the Particles of the Body, Places. Hippocrates in his Booke De Locis in Homine, and De Victus ratione in morbis acutis, calleth also Parts, Places: Yet there are some who distinguish a Member from a Part, and a Particle from a Place. Aristotle calleth those onely Members which are compounded of Parts of diuers Natures, as the Head, the Feet and the Hands; and those that are Similar he calleth properly Parts. Theodorus in Aristotle, thinketh that the name of a Part or Place, is of larger extent then the name of a Member. So also Galen in the sixth of his Method, saith that the Eye may be called a Part or a Member; and the hornie Tunicle a Part, but not a Member. But because in these Philosophicall disquisitions, it becometh vs better, to stand vpon substances, then vpon words; we take no care whether you vse the name of a Part, a Member, a Particle or a Place; it concernes vs more to find out an essentiall definition of a Part.

Auicenna defineth a Part to be a Body ingendred of the first permixtion of the Humors, as the Humors doe consist of the first mixtion of the Meat, and the Meat of the Elements. But this definition of the Arabian, is too presse, strait and narrow, because it agreeth onely to Homogeny parts, and not to Heterogeny: For euerie Man may easily perceiue that Heterogeny or Dissimilar parts are compounded immediately of Similar, not of the first mixture of the Humors. And this Galen teacheth in plaine and expresse words, in his first Booke De Elementis, where he saith, That compounded Parts are immediately made of the Simple or Similar, the Simple of Humors, Humors of Aliments, Aliments of the Elements. They which would salue the Arabians credite, say that his definition is materiall, not formall; for both Similar and Dissimilar doe communicate in the matter, though their forme or difference be diuers; but they forget that an essentiall definition must expresse the Forme especially, because it is the chiefe part of the Essence, as that which giueth being to the Thing. Aponensis defineth a Part to be a solid and thicke Body, begotten of humidities or moistures, and adorned with the powers of Nature; Which definition labourerth of the same disease with the former, comprehending onely simple not compounded Parts.

Galen hath two definitions of Parts. The first, in the first Booke of his Method and the fifth Chapter, and in the first Booke De Elementis, cap. 6. The second is in his first Booke De Versu Partium. The first is this; A Part is that which accomplisheth or integrateth the whole: Or, whatsoeuer addeth any thing to the frame of a humane Body. The second is this; A Part is a Body which neither hath a proper circumscription of his owne, nor yet is on euerie hand ioyned with others. Both these definitions seeme to be too large, comprehending not onely liuing Particles (which are onely, truly and properly Parts) but those also which haue no life, as the Haires, the Nails, the Fat. Hippocrates also vseth this large and ample signification of a Part, in Lib. 6. Epidemion, where ὁμογενεῖα καὶ ὁμοῦρα, that is, Humors and Spirits he calleth Parts. So Aristotle calleth Seed, Blood, Milke, Marrow, Phlegme and Fat or Grease, Parts. Fernelius the French Galen, giueth vs a perfect definition of a Part, in the first Chapter of the second Booke of his Physiologia, and disputeth and scanneth the particuler branches of his definition learnedly & at large. Argenterius (a common Calumniator saith Laurentius) taxeth Fernelius definition, assuming a diuers consideration of Mans body: First as it is a Substance, and so he saith the parts of it are the Matter and the Forme; next as it is a Body, and so the parts of it are all the Corporeall substances therein contained; finally, as a liuing and animated Creature, and in that respect (saith he) whatsoeuer liueth, may be called a part of the liuing Creature, not a part of the Body. Wherefore Fernelius did ill define a Part of Mans body to be A Body cohearing or cleauiing to the whole, and ioyned to it in common life, framed for his vse and function.

But

But these are but nice and friuolous cauils, and indeed extrauagant from a Physitians consideration: For a Physitian doth not consider the Body of a Man as it is a naturall Body, consisting of Matter & Forme, but as it participateth of health, or is obnoxious or liable to sicknesse. And therefore *Fernelius* doth well determine that those Bodies onely are to be called Parts, which may be the Subiects of sicknesse and health. Now those Parts onely are afflicted with diseases, which performe some actions in the Body, and actions belong to living Parts, not to those which haue no life. For sicknesse is an indisposition which at the first hand and immediately hurteth or hindreth the action. And therefore *Fernelius* his definition is exquisite and perfect, becomming a good Physitian.

Fernelius
defended.

QVEST. II.

Of the principalitie of the Parts against the Peripateticks, prouing that there is not one onely Principall, to wit, the Heart.

Concerning the principalitie of the Parts, there is a famous difference betweene the Physitians and the Philosophers. The great *Genius* and Interpreter of Nature *Aristotle*, in the seuenth and the tenth Chapters of his second Booke *De Partibus Animalium*; in the fourth Chapter of his third Booke *De Partibus Animalium*; in his second Booke *De Generatione Animalium*; in his Booke *De Vita & Morte*; in his Bookes *De Somno* and *De Causa Motus Animalium*, determineth that there is but one Soueraigne in Mans body, and one Principle, which in his bosome & imbracement containeth and comprehendeth all the Faculties. And this he resolueth is the Heart, the Fountaine (saith he) of the Veines, Arteries and the Sinews; the Source of Heat, Spirits and quickning Nectar; the first and onely Store-house of Blood, or Worke-house of Sanguification; and finally, the Seat and Mansion-house of the Vegetatiue, Sensatiue and reasonable Soule. In *Aristotles* foot-steps haue walked *Auerroës* in the second of his *Collectanies*, *Aphrodisseus* in his first Booke *De Anima*, and many other both *Greekes* and *Arabians*: But they bring for confirmation of their opinion no necessarie Arguments, but such onely as are probable, shadowed ouer with a veile of truth.

Aristotle
would haue
but one prin-
cipal part, and
that the heart

It is more honourable (say they) and monarchicall, that there should be one Principle then many; and that the verie name of a Principle doth necessarily import so much. For if the Soule of the Creature be but one in number, and that indiuisible, then must the Body likewise of it be, either one whole, or at least haue some one Principall part; for Effences must not be multiplied without necessitie. And as in the great Vniuerse which we behold, there is one Principle, which *Aristotle* in the eighth Booke of his *Physicks*, calleth *Primum Mouens* and *Primus Motor*, that is, *The first Mover*.

The argu-
ments of the
Peripateticks:
The first.

Ὁὐκ ἔστιν ἄλλοτερον ἀντικειμενόν, ἐκ τοῦ κοινού.

'Tis naught to haue more Kings then one,
Let him that raignes, raigne King alone.

So in the *Microcosme* or Little world, there must be but one Principle, one Prince, which is the Heart, whose excellencie and dignitie aboue the rest of the Parts, these things doe cleerly demonstrate. First, because it liueth first and dyeth last; and therefore is the originall of Life, and the Seat of the Soule. Next, because it endureth no notable disease, but yeeldeth presently to Nature if it be afflicted. Againe, because it obtaineth the most honorable place, that is, the middle of the Body. Fourthly, for that by his perpetuall motion all things are exhilarated and do flourish: And nothing in the whole Creature is fruitful, vnlesse the powerfull vigour of the Heart do giue foecunditie vnto it. There (say they) is the Mansion and Tribunall of the Soule where heat is to be found, the first Instrument of all the Functions; but the Heart is the springing Fountaine of Natiue heat, which by the Arteries as it were by small Riuerets, is deriued into the whole Body. Moreover, the Seat of the Faculties is there, where the Organs of the same Faculties do appeare; but all the Veines, Arteries and Sinews, doe arise out of the Heart. For the Arteries no Man euer made doubt. The Veines doe surely arise thence, where their end and termination doth appeare: But that is about the Heart; for the implantation of the great Arterie and the

The dignitie
of the Heart.

The second.

The third
The heart th
originall of
the veines.

The heart the
originall of
the Sinewes.
Aristotle.

The fourth
argument
The heart the
first store-
house of
Blood.

The heart the
first Sensor.
The first
reason.

The second.

The third.

The fourth.

The fifth.

A confutation
of the Peripa-
tetics.

Demonstra-
tione argu-
ments to proue
that the heart
is neither the
originall of
the veines, nor
of the sinewes.

hollow Veine are alike. Beside, all the veines are continuat with the Heart, to it are they fixed, where they also haue Membranes set like Doores vnto them, which seeme to be the beginnings and heads of the Veines; but through the Liuer they are onely disseminated, and the rest of the Entrals they make a passage through, and so end into haire strings. Aristotle also is of opinion, that the Heart is the originall of the Nerves; for his Flesh is hard, thight and some-what membranous; but the Ventricles thereof haue in them infinite textures of manifest Sinewes.

Finally, the Heart is the first *αὐτοσκοπικὸν*, the first *ζῳτικόν* and the first *κινητικὸν καὶ ἐκσπικτικόν*, that is, *Sanguifier, Liuer, Mouer and Sensor*. That it is the first Sanguifier or the Workhouse wherein the Blood is made, the Philosopher demonstrateth; because in it the Blood is contained as in a Vessell or conceptacle and receptacle; whereas in the Liuer it remaineth but as in a Pipe or conueyance; and beside, no where in the whole Body is the Blood contained out of his Vessels, saue onely in the Heart, which therefore is the Treasure thereof; and therefore in all suddaine passions of the mind, it returneth and flyeth to the Heart, as to the Fountaine, not to the Liuer or to the Braine.

That it is *Primum sensorium*, the first sensor (that is) that the faculties of sense, motion and appetite, are deriued from the Heart, the *Peripateticks* proue by these Arguments. Because in a *Syncope*, that is, a swoounding where the vitall spirits faile, there appeareth a suddaine and head-strong ruine and decay of all the faculties. Because in all suddaine motions and approaches of noysome and hurtfull things, as also when we would auoid them, the heat of the Heart being drawne inward, there appeareth a pale wannesse in the Face; and on the contrarie, when we conceiue ioy for any thing that is profitable, or when we pursue such things, the heat of the Heart being called outward, there appeareth in the countenance a ruddinesse and alacritie. Because if the Arteries called *Carotides* be tyed or obstructed, then followeth presently a senselesse dulnesse, and a priuation of the Animalitie, if I may so speake, the Patient lying like a senselesse Stocke. Because Ioy, Sorrow and Hope, are motions of the Heart, in which consisteth all the Appetite we haue to pursue that which we like, or to flye and auoid that we dislike and abhorre. Finally, because in sleepe the Animall faculties doe rest and cease from their labors: Now sleepe is nothing else but a retraction or calling backe of the heat to the Heart from the other parts wherein it was in continuall expence; and that is the reason why a Man after sleepe is so much refreshed, and riseth strong againe to the labor either of Mind or Body, albeit in both he were well wearied, yea tyred out before. As for the Braine (they say) it cannot be the Author of Sense, because it is of a cold temper, vnapt for motion, and made onely to refrigerate and coole the exceeding heat of the Heart, being of it selfe without all sense. These and such like are the Arguments of the *Peripateticks*, by which they perswade themselves, that there is but one Principle of Mans body, which is the Heart.

But these conceits of Aristotle and the Philosophers, are long since hissed out of the Schooles of the Physitians, and banished from amongst them; because they assume those things for true which are vtterly false, and obtrude things probable as if they were necessarie. And what I pray you is more absurd, then to preferre the probabilitie of a Logicall argumentation, before the euidence of Sense, Reason and Experience, ioyned together? Now that the Veines doe arise from the Liuer, that the Nerves or Sinews which are soft and medullous or marrowy within, and without cloathed with Membranes, are deriued from the substance of the Braine, he that hath but one Eye may cleerely discerne. That great Philosopher obserued in the Heart many Fibrous strings in both his Ventricles, wouen out of the extremities of the small Membranes, and mistooke them for thready Nerves; whereas indeed it hath but one small Nerve arising from the sixth coniugation of the Braine, which looseth it selfe in his substance. He saw the hollow veine in the Heart verie large and ample; but he did not obserue, that it onely openeth into the Heart; (gaping at it with a spacious Orifice or mouth) to poure into the right Ventricle, as it were into a Cisterne, sufficient Blood for the generation of Vitall spirits, to supply the expence of the whole Body, but goeth not out of the Heart; as doeth manifestly appeare by those three forked Membranes, or Valves and Flood-gates, yawning outward, but close inward. But because we shall haue fitter occasion hereafter to dispute this Question with them, of the originall of the Veines and the Sinewes, it shall be sufficient that we haue said thus much of it at this time.

As for the Seat of the Faculties of Sense and Motion, is it not against all reason and experience,

experience, to place them in the Heart? The Heart indeed is moued, and that perpetually; but that motion is not voluntarie but naturall; it is moued, yet not at our pleasure, but according to it owne instinct. Daily practise and experience teacheth vs, that when the Ventricles of the Braine, are either compressed or filled and stuffed vp, as in the Apoplexy, Epilepsie and drowfie *Caros*, then all the Faculties are respited and cease from their functions; but when the Heart is offended, the life indeed is indangered, but neither Motion nor Sense intercepted.

That the Heart is not the beginning of Animall motion.

Againe, If the Heart were the Seat of all the Faculties, as the *Peripateticks* would faine haue it, then vpon any affection of the same, or notable deprauation of his temperament, all the functions should be impeached; because all actions come from the Temper. But we see that in a *Hectique* Ague or Consumption, wherein there is an vtter alienation of the Temper (as being an equall distemper, of all distempers the most dangerous) yet the voluntarie and principall Faculties, doe remaine inuiolate. In the violent motions, and throbbing palpitations of the Heart, which (some say) haue been scene so extreme that a Ribbe hath bene broken therewith, yet neither the voluntarie motions of the parts are depraued, nor the mind at all alienated or troubled. Who will deny, but that by pestilent and contagious vapors and breaths, comming from the byting of venomous Beasts, or the taking of Poyson, the Vitall facultie is oppugned, and as it were besieged in his owne Fortresse? But yet those that are so affected, doe enioy both sense and motion, euen to the last breath most times. When the Braine is refrigerated, sleepe presently stealeth vpon vs: Now *Aristotle* himselfe defineth sleepe to be *ἡρεσις τῆς πρώτης αἰσθητικῆς*, *The rest of the first sensator*. If any of the principall Faculties, either Motiue or Sensatiue be affected, where doe the remedies applyed auaille? Surely at the Head, not at the Heart. The Braine therefore, not the Heart, is the first Moouer, and first Sensator.

An elegant argument against the *Peripateticks*.

Strange motions of the Heart.

Aristotle.

But the *Peripateticks* obiekt that the Braine hath no sense, and therefore cannot be the Author of it. We will giue them a learned answer out of *Galen*, *The Braines sensation is not παθητικὴς, but ενεργητικὸς*, that is, not passiuely, but operatiuely. It receiueh not the Species or Images of sensible things; but like a Iudge, it taketh knowledge of their impressions, and accordingly determineth of them. They say, the Braine is vnapt for motion, because it is cold. We answer, It was necessarie it should be cold, that is, lesse hot, for the better performance of the functions. But if the Braine had exceeded in heat, then would his motions haue bene rash and vnruely, and his sensations giddy and fond as in a phrensie. In a *Syncope* the Animall faculties doe faile. It is true, but why? Because there is an exolution, and so a defect of Vitall spirits, by which the Animall are cherished. The ligation or interception in like manner of the Arteries of the Necke, called *Carotides*, induceth a priuation of motion and sense, onely because the Vitall spirits are intercepted, which minister matter to the Animall.

The sensation of the Braine not passive but operative.

Why the braine is cold, that is, lesse hot. Answers to the arguments of the *Peripateticks*.

But one Principle is better then many. That we confesse is verie true; but yet we know there are many reasons why it is not possible it should be so in this Little world. We will instance but in a few. It is granted by all Men, that the substance of the Arteries is diuers from that of the Veines; and the substance of the Sinews differing from them both; and as is their substance, so is their structure verie different, and their temper not one and the same: How then could it be, that Organs of so distinct kinds, should issue all from one and the same part? Againe, it was necessarie that these Organs should in their originall be verie large and ample to transfuse sufficient Spirits, and a common matter suddainly and together-ward into the whole Body. Now the magnitude or proportion of any one part (much lesse of the Heart) could not be sufficient for this purpose, either to afford a foundation for so large Vessels, or to supply a competent allowance of matter for them all. Adde hereto, that the Faculties of the Soule, follow the Temper of the Body, and therefore so diuers faculties might not issue from one part, which hath but one single temperament. How can we imagine reasonably, that three distinct and different Faculties, yea oftentimes quite contrarie, Reason, Anger and Concupiscence should reside altogether, as if they were sworne friends in one Organ? Or how when the Heart is on fire with Anger, should Reason make resistance, which delighteth in a middle and equall temper? Doe not the Vitall and Animall faculties require a different temper? Their Organs therefore must also necessarily be different and distinct. For the Heart is by Nature fitted to containe and propagate the Vitall facultie; but for the preservation of the Animall, it is vtterly incompetent. The reason is at hand. The Vitall spirit is verie hot, impetuous, raging,

Why in the Little world there cannot be onely one Principle. The first demonstration

The second.

The third

The fourth.

and in continuall motion, and therefore stood in need of a strong Organ wherein it should be wrought and contained, that the Spirit might not because of his tenuitie, be exhaled, nor the Vessell by which it is conueyed, breake in perpetuall pulsing and palpitation; which both would easily haue hapned, if the Heart and Arteries had beene thin, and of a slender texture. The Animall facultie required another temper in her Organ, otherwise the Motions would haue beene furious, the Senses giddy and rash; Reason would continually haue erred, because the propertie of heat, is to confound and make a medley of all things, shuffling in one thing huddlingly vpon another, through his continuall & indefinent motion. And these are the Arguments whereby the opinion of the *Peripateticks* is expelled out of the Schoole of the Physitians.

How *Auicen* interpreteth *Aristotle*.

Auicen, *Fen prima primi, doctrina* 5. cap. 1. interpreteth *Aristotles* opinion, playing the stickler in this manner. All the Faculties (saith he) doe reside in the Heart, as in their first Root, but yet they shine in the other Members, that is, the Heart is the originall of diuers Faculties, but vseth the Braine as the Instrument of Sense, so that *Radically* (that is his word) the Animall facultie is in the Heart, but by *manifestation* in the Braine.

The opinion of some later writers, and their diuers distinctions.

Some againe intercede for the *Peripateticks*, and say, That the principall Faculties, motiue and sensitiue, are in the Heart, as in their originall and fountaine. That the Roots of the Nerues are in the Heart, but because it is too narrow to yeeld out of it selfe all their propagations, they thinke the Braine was framed as a second Principle, wherein the Animall functions might, not obscurely as in the Heart, but evidently manifest and exhibite themselves. And this Power or Facultie when the Braine hath once receiued it from the Heart, standeth in no need of continuall and immediate assistance there-from, but onely of a supply after some time: Euen as the Commander of an Army, who hauing receiued his Authoritie and his Companie from the Prince, standeth in no farther need of the Princes protection, vnlesse it be now and then vpon especiall seruices. They conclude therefore, that the Braine and the Liuer are truly called Principall parts; but this principallitie is but delegatorie from the Heart, no otherwaies then the Lieutenants of Princes, by them chosen for such and such employments, doe receiue from them an order and power of dispensation and disposition, whereby they are authorized, and so taken, as if they were immediate Commanders themselves. Some others vse an other distinction, and say that materially the Nerues proceed from the Braine, and the Veines from the Liuer; but the first and the formall Principle they say is in the Heart.

Comparison

Scaligers opinion.

That Prince of humane Learning (at least, he that affected that Soueraigntie) *Iulius Caesar Scaliger*, in the 289 Exercise of his Booke *De Subtilitate*, maketh many principles in the Heart. The first or primarie is τὸ ζῶν or the living: The secundarie τὸ κινητικόν or the mouing Principle: These doe neuer cease, neither are they hindered or intercepted in our sleepe or repose: Yet are they not τὰ πρῶτα ἀιδιτικὰ tamet si τὸ πρῶτον ἀιδισιμὸν, that is, they are not the first *Sensators*, though they be of or from the first *Sensator*. Thus learned Men labor to reconcile the *Peripateticks* and the Physitians. But they seeme not to hold themselves close to *Aristotles* meaning: For he doth not thinke that in any sense, the Braine can be said to be the Author or originall of Sensation, neither that the Nerues doe arise from it. No where doth he attribute any delegatorie power of Sensation vnto it; but thinketh it was onely made to refrigerate or coole the heat of the Heart; whereas, notwithstanding all he can produce, it is the first Principle of Sense and motion, neither receiue any power for the performance of either of them from the Heart.

The late writers did not vnderstand *Aristotle* well.

The opinion of the *Arabians* confuted.

And whereas the *Arabians* say, that the Animall facultie is *radically* in the Heart, and but by *manifestation* in the Braine; we can no way admit of that distinction: For if that Facultie were in the Heart as in the Root, then when the Braine is obstructed, the Body should not become senselesse and without motion, because there should be a remainder both of Sense and Motion in the Root, that is, in the Heart. But though the Heart be obstructed, or the passages intercepted betweene it and the Braine, yet there followeth not any suddaine priuation of Sense and Motion. Instances hereof we haue in Sacrifices, where the Beast some-times hath beene heard to cry, and some-times also seene to run a little while after his Heart hath beene cut out: And we haue seene the same tryed in a Dogge, which ran crying a while after his Heart was cut out, the Vessels arising from it vpward, being before bound.

Sacrifices run from the Altar without their Hearts.

Galen elegant demonstration

Galen in his first Booke *De Placitis*, illustrateth the whole matter, by an elegant demonstration. If the Heart (saith he) did giue vnto the Braine the Animall facultie, then should

that

that power be deriued either by Veines, Arteries or Sinewes; for there are no other Vessels which goe betweene them, and are common to them both. By Veines or Arteries *Aristotle* himselfe doth not thinke it is conueyed; besides, these Vessels doe not directly passe vnto the Braine, but after diuers contorsions and aberrations from a right and direct progresse. That it is not deriued by or through the Nerues is manifest; because, if the Nerue which is disseminated through the substance of the Heart, be either diuided and cut asunder or intercepted, yet the Creature doth not presently fall, but onely groweth mute and dumbe.

It is therefore more consonant to right reason, that seeing the Soule is but one and a simple substance, and wholly in the whole, and wholly in euerie Particell of the Body; and therefore must necessarily haue the helpe of Organs for the accomplishing of her seuerall functions: to assigne the Seat of the Facultie there where the Organs of those Faculties are especially to be discerned. Wherefore seeing the *Peripatericks* doe confesse, that the Organs of Sense and Motion are more conspicuous in the Braine then in the Heart: why will they not yeeld to the Physitian, that the Animall facultie is in the Braine, the Vitall in the Heart, and the Naturall in the Liuer; but make all the world witnesses of their refractarie minds, then which in a true Philosopher nothing is more illiberall? Howloeuver to conclude, we subscribe to the opinion of the Physitians, who haue banished this Vnitie of Principles out of their Schooles.

The conclusion of the whole disputation.

QVEST. III.

How many Principall parts there are.

BY those things which we haue thus at large discoursed, it is manifest to all Men, that there is not one, but many Principall parts of Mans body; it remaineth that we shew you now how many there are. The number we cannot better apportion, then from the nature and definition of a Principle. First therefore, we must make it appeare (because Physitians herein doe not agree) what a Principall part is.

Galen in his Booke *De Vsu Partium*, defineth this Principallitie by Necessitie. That is a Principall part, which is of absolute necessitie for the life of Man. I will shew you (saith he) by what markes you shall know a Principall part, to wit, by the profit it brings; now the profit of a Part is three-fold, either it is simply for life, or for better life, or else for the preservation of them both; and all such Parts without doubt, are truly Principall. And in the first Chapter of the fourteenth Booke *De Vsu Partium*, Nature hath a three-fold scope in the structure of the Parts of Mans body. The first is of those which are necessarie for life; and such Parts are called Principall, as the Braine, the Heart, and the Liuer, &c. We will therefore define a Principall part to be *that which is absolutely necessarie for the preservation of the whole individuum or particular Man.*

What a principall part is. *Galen.*

Argentarius, who in a humor of contradicting *Galen*, opposeth himselfe vnto him, reiecteth this definition; because if a Principall part be defined by necessitie, the Stomacke, the Loynes, the Spleene, the Bladder and the Kidneys, will all fall into the reckoning of Principall parts. For the Action of the Stomacke is necessarie also for life. The Motion of the Lungs we cannot misse, no not for a moment of time; the interception of the Vrine is mortall; and therefore the excretion or auoiding thereof, which is accomplished by the Kidneys and the Bladder is necessarie. But he seemeth to me not to haue attained to the thorough vnderstanding of *Galen*'s mind: For there is a double necessitie of the Parts; one absolute for the preservation of the *individuum*, another not *absolutum*, that is, simply and absolutely, but *secundum quid*, or hauing reference to the former. The first maketh a Part principall, as the Braine, the Heart, and the Liuer: The second kind of necessitie, is but relatiue or collaterall, by which some Parts owe obseruance to the Principall, as necessarie seruitors vnto them. For example: What necessarie and immediate offices doe the Lungs, the Kidneys, the Bladder and the Spleene performe to the Arme, the Legge, or the Stomacke? But the Heart giueth them Life, the Liuer affordeth Nourishment, and the Braine supplyeth them with Sense and Motion.

The first definition of principallitie.

Argentarius his vaine opposition to *Galen.*

Argentarius answered. A double necessitie of the parts.

This may seeme some-what obscure to those that are but Catechists in our Art, but by examples we shall make it sufficiently perspicuous. The Liuer is the onely Prince in the lower

How the
other parts
serue the prin-
cipall, and in
that regard
are necessarie.

Galen
answer to the
former cauill.

A story of a
Malefactor.

*Sexto de
placitis.*

How the
Lungs serue
the Heart.

An obiection
against *Galen*.

The answer
to the ob-
iection.

Another
definition
of a Princi-
pall part.

Aniceti
definition of
a principall
part.

A definition
of the late
writers.

lower Region or Belly, being therein alone absolutely necessarie, and at his owne cost, nourishing the whole Family of the Body; all the other Parts within his Precinct are made for his vse. The Stomacke as a Seruant ministreth Meat vnto him; the Bladder of Gaull purgeth away the Choller from that Meat; the Spleene drayneth away the Melancholy Iuyce, and the Kidneys the serous or whayie Humor: all concurring to depure and cleanse it from Excrements to his hand. If therefore they be necessarie, it is not for the preservation of the whole Man, but because they be necessarie Ministers to assist the Liuer in his worke. Againe, the Heart sitteth in the middle Region as in his Palace, the Lungs, the Midriffe, and all the Arteries attending him for his vse, whom he employeth in quickning the whole Body; the same may be said of the Braine. Wherefore the Braine, the Heart and the Liuer, are onely Principall parts, because they alone are immediately and absolutely necessarie for the preservation of euerie particular Creature. *Galen* also answereth this cauill another way, on this manner. The action of the Stomacke is not absolutely necessarie, but onely for the continuance and prorogation of life. Witnesse those Creatures which mew themselves vp all Winter, neuer eating, and so not vsing the action of the Stomacke, albeit they liue nathelesse. Furthermore, nourishing Clifters doe not ascend vnto the Stomack, yet they are sucked by the Meseraick-veines, & transported vnto the Liuer, and so sustaine the Body, as may be instanced in that Malefactor, who after he was taken from the Gallows, was found to be aliue, and a good while sustained by such Clifters, when it was not possible to get any thing into his Stomacke. A Creature therefore may for a time liue without Chilification, which is the action of the Stomacke, but not without Sanguification, saith *Galen*, which is the proper function of the Liuer.

That which is obruded concerning the Lungs, is of no moment; for they worke rather for the commoditie of the Heart, then for the immediate maintenance of life. The Heart might satisfie it selfe with Aire attracted through the rough and smooth Arteries; but lest the outward impuritie thereof suddainly rushing into the Ventricles should offend it, Nature hath cautelously set the Lungs betweene them, as a Shoppe wherein the Aire is broken and dulcified before it come vnto the Heart. And thus much may suffice to satisfie the former obiection, and to euince that onely those parts are principall, which are absolutely and immediately necessarie for the preservation of life.

But there are others which oppose *Galen* to *Galen*, who in the first Chapter of his first Booke *De Locis Affectis*, affirmeth, that the Heart onely is absolutely necessarie for the life of the Creature: His words are these, *If the Creature be neither nourished, nor haue sense or motion (which hapneth in such as lye within the Earth) yet may it liue as long as the Heart is not violated; but if the Heart be defrauded of respiration, the Creature instantly perisheth.* To this we answer: That in bloody and perfect Creatures, the action of the Braine and the Liuer, are absolutely necessarie; but those Creatures which liue so mewed vp in Winter, are vnbloody or without Blood, although it cannot be denyed, that Hysterically women, that is, such as haue violent fits of the Mother, doe liue some good space without breathing, as we could instance in many, if it were not so ordinarie, as that no Man will deny it, but they haue the vse of Transpiration.

There is also another very elegant definition of a Principle, in the tenth Chapter of *Galen*s sixth Booke *De Placitis*, in these words: *That is called a Principall part, which alloweth or affordeth to the whole, either some Facultie, or at least some Matter.* According to this definition also, there will be three Principall parts. For that the Braine doth transmit the Animall facultie, and the Heart the Vitall, will be easily yeelded vnto vs. All the scruple is about the Liuer, because it seemeth not reasonable, that it should afford to the particular parts, a naturall influent Facultie, seeing euerie part hath such an one bred, and seated in it selfe. For the time we let passe that Controuersie, it is sufficient for our present purpose, to proue it a Principall part, though it yeeld no Facultie, if it yeeld a Matter to the whole Body, which no Man in his right wits but will easily confesse, or let him but pricke his Finger and he shall see it.

Aniceti *Fen 1. Doct. 5. Cap. 1.* defines that to be a Principall part, which hath in it selfe the Originall or beginning of the first and chiefe Faculties of the Body; or wherein the power or efficacie of those Faculties, by which the Body is dispensed or gouerned, doth as in his chiefe Seat especially reside and manifest it selfe. Some of the late Writers haue defined a Principall part to be that, which out of it selfe exhibiteth and communiceth to other parts some active Instrument; as for instance, a Spirit. So that which of all these definitions

definitions we accept of, it will still remaine that there are three Principall parts, the Braine, the Heart, and the Liuer. For if we respect Necessitie, these onely are absolutely necessarie; if the Originall of the Faculties, in the Braine resideth and shineth the Animall, the Vitall in the Heart, and the Naturall in the Liuer; if the Instruments, then from the Braine floweth the Animall spirits by the Sinewes, the Vitall from the Heart by the Arteries, the Naturall from the Liuer by the Veines; and by those passages are all diffused from their Fountaines into the whole Body.

Galen in his Booke *De Arte Parua*, addeth to the Principall parts a fourth, to wit, the Testicles: Not in respect to the *indivium* or particular Creature, but because they are of absolute necessitie for the conseruation of the kind, and production of increase. For the Testicles indeed doe not make allowance to the whole Body of any Matter, or Facultie, or Spirit, but onely of a Qualitie, together with a subtile and thin breath or aire, from which the Flesh hath a ranke tast of the Seed, and the Body a strength or farther abilitie in the performance of his actions.

QVEST. IIII.

Which of all the Principall parts is the most noble.

Having præmised this Disputation concerning the number of the Principall parts, it remaineth (because we would haue nothing wanting which may giue satisfaction to such as desire it) that we enquire which of all the Principall parts is worthily to be preferred aboue the rest. Galen in his first Booke *De Semine*, preferreth the Testicles to the Heart; where he saith: *The Heart is indeed the Author of liuing; but the Testicles are they which adde a betternesse or farther degree of perfection to the life*, because if they be taken away, the iollitie and courage of the Creature is extinguished; the Male followeth not his Female, the Veines loose their Latitude, and become sunke and narrow; the Pulse abateth of his strength, & becomes weake, dull & languishing; the Skin is pild and bare, whereupon such Men are called *Glabriones*; and in a word, all Virilitie or Manhood vanisheth away. Galen addeth: The Testicles are another Fountaine or Well-spring of in-bred heat; the Feu-place or Fire-hearth, where the *Lares* or Household-Gods of the Body, doe solace and disport themselves: From hence the whole Body receiueth an increase of heat, and by that meanes not onely Fœcunditie, but also a great alteration of the Temper, the Habit, the proper Substance, yea and of the manners themselves: So that to say true, their power is verie great, and almost incredible, then especially knowne when it is wanting, as we may obserue in Eunuches.

Wherefore as to be and liue well, is more excellent then simply to liue and haue an Idle and sluggish existence, so the Instrument of the former which is the Testicles, is more excellent then that of the later, which is the Heart. A probable but a sophisticall argument. True it is, that which giueth better life, if it giue life also, is more excellent then that which giueth life onely: But the Testicles doe not giue life at all, the Creature can liue without them; they adde indeed a perfection, not to life, that is, to the concrete as we say, but to liuing, that is, to the abstract; so doe the Eyes, so doe other parts, without which a Man should liue, but in liuing should be miserable: The Heart therefore giueth the Substance, the Testicles exhibit but an additament, which may be away, albeit it be with notable detriment; detriment I say, not of that which the Heart giueth, which is the Substance; but of that which themselves afford, which is a Complement. Now that a Substance is of more excellence then a Complement no Man will deny, the Heart therefore is more noble then the Testicles. But the Heart hath a greater concurrent in this plea of Honor, which is the Braine.

The *Peripateticks* and *Aristotle* their Prince, together with the whole Family almost of the *Stoicks*, especially *Chrysippus*, doe giue the preheminance to the Heart, as well because it is seated in the middest, which is the place of Honor; as also because it is a liuing and abundant Fountaine of natiue heat; and finally, because it is the speciall habitation of the Soule; for euen *Hippocrates* himselfe, the Oracle of Physicke, in his Booke *De Corde*, placeth the Soule in the left Ventricle of the Heart; and hence it is, that they call the

Heart

Galen protesteth the Testicles before the Heart

Glabriones Galen.

Wherein the Testicles doe shew their power.

Galen subtle argument answered.

Whether the Braine be to be preferred before the Heart.

The opinion of the Peripateticks and Stoicks.

Hippocrates

Heart *καρδιαν, quasi καρδιαν*: For *καρδιαν* signifieth Empire or rule, comming from *καρδιαν, To Command.*

We determine
that the brain
is the prime
principal part

An elegant
demonstrati-
on how all
the body is
serviceable to
the braine.

But all this notwithstanding, we are enforced to yeeld the superioritie to the Braine, because his functions are more diuine and more noble then those of the Heart. For example: All sense and voluntarie motion proceed from it, the Habitation it is of Wifedome, the Shrine of Memorie, Iudgement and Discourse, which are the prerogatiues of Man aboue all other Creatures. This is the Prince of the Family, and the Head is the Head of the Tribe, all other parts are but attendants (though some serue in more honorable place then others) and owe homage vnto it, yea all were created onely for his vse and behoofe. For the Braine being the seat of the intelligible or vnderstanding Facultie, it was requisite first, that it should be supplied with phantasmes or representations; these representations could not be exhibited and represented to the vnderstanding, but by the ministry of the outward senses. For it is a rule in Philosophy, *Nihil est in intellectu quod non prius fuit in sensu. There is nothing in the vnderstanding or intellect which is not first in the sense.* It was necessarie therefore, that the Senses should be created for the Intellect. Furthermore, the Senses could not haue been perfect vnlesse the Creature could haue moued locally to gather his phantasmes out of diuers obiects, as the Bee flyeth from one Flower to another to gather Honey; and therefore Nature ordained the Organs or Instruments of motion, the Muscles, the Tendons and the Nerues. These (vnlesse we should haue crawled vpon the Earth like Wormes) did necessarily require props and supporters to confirme and establish them, whereupon the Bones & the Gristles were ordained; and Ligaments also to knit and swath them together: Now all of them stand in need of perpetuall influence, of heat to quicken them, and of nourishment to sustaine them; both which are supplied, the former from the Heart by the Arteries, the latter from the Liver by the Veines: So that truth to say, there was no other end of the Creation of all the parts and powers of the Body, but onely for the vse and behoofe of the Braine.

Obiection:

Answer.

It will be objected, that the Braine cannot accomplish his functions without the spirits of the Heart, and the influence of his heat. I answer, that that is an inuincible argument of the soueraigntie of the Braine; for the end for which a thing is ordained, is more noble then the thing ordained for that end; the Life therefore & the Heart are but Hand-maids to the Braine. We will adde also this argument, which haply will seeme not incompetent. The Braine giueth Figure vnto the whole Body; for the Head was made onely for the Braine; now *Hippocrates* saith, that the nature of all the rest of the Bones dependeth vpon the magnitude of the Head: Not that all the Bones deriue their originall from the Head; but because it behooueth that they should be all proportionably answerable to the Bones to which they are articulated, as the Legs to the Thighes, the Thighes to the Haunches, the Haunches to the Holy-bone, the Holy-bone to the Spondels or Rack-bones, the Rack-bones to the Marrow of the Backe, and that to the Braine.

The former
arguments of
the Peripate-
tics & Stoicks
answered.

The argu-
ment re-
torted.

Exposition of
Hippocrates

A rule in the
disposition of
the parts.

Galen

For satisfaction to the Arguments before vrged by the *Peripatetians* and the *Stoicks*, we say, That the *Etymon* or deriuation of the name of the Heart, is but friuolous and not worthy the standing vpon. For the scite of the Heart in the midst, it doth weigh *tantumdem*, as much as nothing; neither indeed is the ground of it true: For of the whole Body, the Nauell is the Center; and for the Trunke or bulke, who euer said (that was an Anatomist) the Heart was in the mid'st of it? But if we will draw an Argument of dignity from the scituation, then will the true superioritie fall to the Braine, because it is placed vppermost, as the Fire aboue the inferiour Elements; the highest Heauen the seat of the blessed Soules, aboue the subiected Orbes; for to be placed aboue, is high superioritie and preheminance; to be thrust downe below, betokeneth base subiection & inferiority. As for that place of *Hippocrates*, where he placeth the Soule in the left Ventricle of the Heart, either he speaketh to the capacitie of the vulgar, or else by the Soule he meaneth the heat, as haply we shall haue more occasion to shew hereafter. We conclude therefore, that of the principall parts, the first place belongeth to the braine, the next to the heart, the last to the liuer. Again, in the *Oeconomie* or order of the parts, this rule is obserued; that those which are first in order of nature, are last in dignity & excellency: So the Infant first liueth the life of a plant, then like a beast it moueth and becommeth sensible; finally, it receiueth it's perfection when it is indued with the reasonable soule; as hauing then the last hand and consummation from the Creator, when he setteth his Stampe or Image vpon it.

Galen in the last Chapter of the seuenth Booke of his Method, compareth the dignitie and

and necessitie of the three principall parts one with another in these words: *The dignitie of the Heart is verie great, and in sicke Patients his action and the strength of it, of absolute necessitie; the Braine is of equall moment for the preservation of life, yet the strength of his actions is not so immediately necessarie in those that are diseased, for their recoverie; the action of the Liuer is as necessarie as either of them for the maintenance of the particular parts, but yet for present and immediate sustentation of life, it is not so instantly necessarie as both the former.* To conclude this question, there is a three-fold principle; one of Beginning, another of Dignitie, a third of necessitie. The *Parenchyma* or Flesh of the Liuer is the originall principle; the Braine is the most noble principle; and the Heart of most necessitie; yet they all haue such a mutuall connexion and conspiration, that each needeth others assistance, and if one of them decay, the rest doe forth-with perish. Euen as in a well-gouerned Citie or Common wealth there is a wise Senate to guide it, a stout and valorous strength of Souldiers to defend and redeeme it, and an infinite multiplicitie of Trades and Occupations to maintaine and support it; all which though they be distinguished in Offices and Place, doe yet consent in one, and conspire together for their mutuall preservation. And this conspiration *Galen* expresth to the life, in his Booke *De Formatione Fetus*, and the fifth Chapter, thus: *When the Heart is deprived of respiration it ceaseth to moue, and immediately death insueth; now it is deprived of respiration when the Nerves (which come from the Braine) are either cut, or obstructed, or intercepted.* As therefore the Heart needeth the helpe of the Braine, and being forsaken by it, maketh a diuorce between the Soule & the Body; so it also maketh retribution to the Braine, supplying it with Spirits of life, out of which the Animall Spirits of the Braine are extracted; and the Liuer though it lye below, yet it yeeldeth matter to them both, whereof and whereby their Spirits are made and sustained.

But against this doctrine of the consent of these principall parts, there is a notable place of *Galen*, in the fourth Chapter of his second Booke *De Placitis*, which needeth to be cleared before we fall from this discourse; for he saith: *As Pulsation and voluntarie motion belong to diuers kinds of motion; so neither of these principles needeth the helpe one of another.* Which place we interpret thus: That the Heart doth not transmit the Animall facultie to the Braine, nor the Braine the facultie of Pulsation to the Heart, because the Temper and Formes of the Faculties are diuers; and therefore the Heart conferreth nothing to the *Idea* or Forme of voluntarie motion, neither the Braine to the power of Pulsation; yet hence it must not be inferred, that the Braine needeth not the helpe of the Heart, or on the contrarie, the Heart of the Braine: And thus much of the definition, and number, and precedencie of the principall parts.

A conference of the dignitie and necessitie of the principall parts.

The decision of the whole question. A three-fold principle.

Comparison

Galen. The mutuall conspiration of the principall parts.

Obiection: *Galen*

A hard place in *Galen* expounded.

QUEST. V.

Of Similar and Dissimilar parts, and first of the number of them.

THe nature and number of the Similar parts because they are much controuerted, we will examine for their sakes, who are not so well exercised in these Schoole-points; that if they be not able to draw out of the Fountaines themselves, they may dip their Vessels in this shallow Ford of ours, to satisfie their thirstie minds.

Some there be that contend, that there are no Similar parts at all, because the most simple are not void of composition; and they alleage *Galen*'s authoritie for it; who in the eighth Chapter of his first Booke *De Elementis*, saith: *That the simple parts are made of Humors, Humors of Aliments, Aliments of Elements.* And in his first Booke *De Semine*, *All parts are generated of Seed and Blood.* But the answer to this is easie and obuious; for parts are called Similar, not because they are exquisitely simple and uncompounded, but because they cannot be diuided into *Parts* of diuers kinds, neither yet are compounded of any other *Parts*, though they be of diuers substances. So the Philosopher calleth the Elements simple Bodies, because they are not compounded of other *Bodies*, although they consist of Matter and Forme. Yea the verie Soule of Man is not in this sense truly simple, nor yet the Angelicall substance; for if they were, they should be inpatible; And indeed nothing is truly simple but God himselfe; but we of purpose giue ouer this mysterie before we enter into it, because every one is not a fit Auditor of this kind of Philosophy. The number of

That there are no Similar parts. *Galen.* Obiection.

Answer. Why Similar parts are so called.

The Soule of Man is not simple.

The number
of the Similar
Parts.
Galen.
A three fold
kind of Flesh.

Galen.

Galen.

14 Similar
Parts after
Galen

Galen
accused.

Argenterius
answer for
Galen
insufficient.

Galen

The common
answer for
Galen
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Obiection.

Galen.

Montanus
answer to the
Obiection.

Obiection.

Solution.

A Similar
part may also
be said to be
organically.

of the Similar particles concerneth vs at this time more, wherein there is great heat and contention of opinions. *Galen* in his Commentaries vpon *Hippocrates* Booke *De Natura Hominis* numbred seven: *Bones, Gristles, Ligaments, Membranes, Fibres, Fat and Flesh*. And whereas there is a threefold kind of Flesh, one of the Muscles which is indeed true Flesh, another of the Entrails which is called *πασιχυμα*, and the last of the particular parts; he accounteth them all Similar, for so he speaketh in the sixth Chapter of his first Booke *De Naturalibus Facultatibus*. Among the Similar parts are to be accounted the Flesh of the Liver, the Spleene, the Kidneys, the Lungs and the Heart; as also the Coates of the Stomach and the Guts, and the proper body of the Braine. For if from all of these you shall exempt or take away, either really or in your imagination, the Veines, the Arteries and the Nerues; the Body which remaineth will be Simple & Elementarie. In the sixth Chapter of the first Booke *De Elementis*, he addeth to the former seven, *Sinews, Marrow, Nails and Haire*. In his Booke *De Inaequali Intemperie*, *Tendons* and *Skin*. In his Booke *De Differentijs Morborum*, and in the second Booke *De Elementis*, he addeth *Veines* and *Arteries*. So that according to *Galen* in the places alleaged, if we summe vp the Similar parts, they will arise to fourteene: *Bones, Gristles, Ligaments, Membranes, Fibres, Nerues, Arteries, Veines, Flesh, Skin, Fat, Marrow, Nails and Haire*.

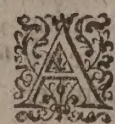
Many accuse *Galen* of leuitie and forgetfulness, because in diuers places he calleth Veines, Arteries and Nerues Similar parts; and yet in his Booke *De Inaequali Intemperie*, he accounteth them Dissimilar and Organicall. *Argenterius* answers for him; That in a Similar part, he hath a double respect to their Matter and their Forme; and whereas he calleth Nerues, Veines and Arteries, Similar Bodies, he doth it with respect to their Matter, which is simple & vniforme; where he calleth them Organicall, he hath respect to their Forme and Figure, which is round and more or lesse hollow. But *Argenterius* by this answer, rather betrayeth then redeemeth his Master: For the matter of the Veines, Nerues and Arteries, is not vniforme. *Galen* in his Booke *De Placitis* and *De Vsu Partium*, teacheth that Nerues are withinward soft and marrowy, outward membranous; as also the bodies of Arteries are woven of Membranes and Fibres.

The common and vulgar answer for *Galen*, we rather approue, which is after this sort: There are two kinds of Similar parts, some are so in truth, as *Bones, Gristles, &c.* others Similar to the iudgement of the Eye, such are Veines, Arteries and Nerues; because at the first view when we cast our Eye vpon them, we perceiue an vniformitie in their substance. But some Man will vrge farther, that euen in the iudgement of the Eye, those three Vessels aboue named, are not simple but compounded; for our Eye bewrayeth the in-side of the Nerue to be Medullous, and the out-side Membranous. And *Galen* in the sixth Chapter of his first Booke *De Naturalibus Facultatibus*, saith: That Similar particles are by no other meanes to be discerned, but by Dissection and Autopsia: that is, by the Eye of the Anatomist. This scruple *Montanus* thus remoueth: There is, saith he, a double Anatomy, one most exquisite and artificiall, another more rude according to the times wherein *Hippocrates, Diocles* and *Erasistratus* lived, when the Art was in her infancie: And to these times, the Nerues, Veines and Arteries seemed at the first sight Similar parts, albeit since as the Art hath gathered strength, and Men growne more oculte priers into the Nature and Frame of the Body, there hath been some difference discerned.

It will be further obiected, that there are more Similar parts then *Galen* and the Schoole of Physitians haue described. For the Marrow or substance of the Braine, the Christalline humor of the Eye, the Pith of the Backe, as also the other humors of the Eye are truly and in the nicest construction Similar parts. We may answer, that all these are indeed truly Similar, but yet they all concur to the frame of one part; but *Galen* spake onely of those Similars, of which as of sensible and common Elements, many Dissimilars were compounded.

QUEST. VI.

Whether a Similar part may be called Organicall; and whether the actions belong to the Similar parts, or to the Organicall.



According to the Doctrine of *Aristotle* and *Galen*, a Dissimilar and an Organicall part are not distinguished. But because according to the same *Galen*, the Essence of an Organicall part consisteth onely in the conformation, that is, a conuenient Figure,

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Figure, Magnitude, Number and Scituation, all which are found also in Similar parts; I am easily perswaded to be of the opinion of some of the late Writers, who thinke that Similar particles, may also be called Organically, and therefore that the Dissimilar is better opposed to a Similar, and to an Organically a rude and vnformed part. Neither doe I thinke, that *Galen* was hereof ignorant; but because the varietie of Composition, and the neatnesse of the Figure was more conspicuous in those that are Dissimilar (the Similar being vniforme) he pleaseth to call them absolutely and by an excellence, Organically. So the Philosopher in his first Booke *De Ortu & interitu*, calleth the Head, the Chest, and the Belly, principall Organs, because the most irresolute Scepticke, cannot but acknowledge their action and diuerse composition.

Some vntie this knot on this manner. An Organically part is to be considered either as it is figured, or as it performeth some Organically action. In the first respect, almost all Similar parts are Organically; for euen the Bones haue a proper Figure, Magnitude, Number and Scite. In the second onely Dissimilar, because these alone doe performe Organically actions. For who will affirme, that in a Bone there is any action Organically? It is true, that their Figure, Magnitude and Scite are of good vse, but they performe no action. Whereas the Veine and the Muscled, although of all Organs they are the most simple, doe performe each of them a manifest Organically action; the one distributing and dispersing the Blood, the other accomplishing voluntarie motion. But that these things may be more manifest, and descend deeper into the capacity of those that are but initiated, it shall not be amisse to recall them againe to the ballance, and weigh them ouer more precisely.

Galen in the sixth Chapter of the first Booke of his Method, and in his Booke *De Inaquali Intemperie*, defineth an Organ to be *that part of the Creature which can performe a perfect, that is, a proper action*. More fully it may be defined thus. *A part which onely produceth an action proper and peculiar vnto it selfe*; so a Muscled and an Eye are called Organs, because onely the Muscled moueth, the eye onely seeth. As for the Similar parts, their action is perfect indeed, but common, not proper or peculiar to themselves, to wit, Nutrition; and therefore they cannot properly be called Organs. Now that Nutrition is a Similar, and not Organically action, it appeareth by both their definitions. That action is said to be Similar, which is commenced or begun onely by the Temper of the Part, and by the same perfected; and is beside wholly and perfectly wrought by the least portion of the Part, as well as by the whole. That Nutrition is of that nature, it is so manifest, as it needeth no demonstration; for euerie part or portion of a Bone, draweth, retaineth, boyleth the Aliment; and beside, expelleth that which is superfluous; the reason is, because euerie part of a Bone is a Bone, and hath the forme and nature of the whole Bone: This forme is called *Temperies* or the Temper, wherefore onely from the Temper proceedeth the originall and perfection of Nutrition. Again, *Flesh* (as *Galen* saith in the ninth Chapter of the first Booke *De Vsu Partium*) is *Flesh onely through his temper, and a Nerue is a Nerue by his temper*. And in the first Booke *De Naturalibus Facultatibus*, He that indeauoureth to preserve the action of the Similar parts, it is necessarie that he preserve their Temper. So that it is manifest, that Nutrition accordeth with the definition of a Similar action. Now how repugnant it is to the definition of an Organically action, it remaineth that we shew. That is called an Organically action, which neither is begun, nor absolued or perfected by the Temper alone, but requireth to his integritie & perfection the whole Instrument. So vision, which is the proper action of the Eye, is not accomplished by the Christalline humor alone, nor alone by the Optick-nerue, or the coates of the Eye, but by all together. Neither is the forme of this organically action the temper, but the laudable conformation of the whole Instrument. The Eye seeth not, the Hand handleth not, the Foot goeth not forward, the Muscled moueth not onely by the Temper; but because the Organs are thus or thus disposed or framed.

Here some ouertaken with irresolution, because of the obscuritie of the Question, doe sweat and contend to proue, that all actions belong to the Similar parts & proceed from them, none from the Organically. And they alleage the authoritie of *Galen* for their warrant; who in the second Chapter of the seuenth Booke of his Method, and the third Chapter of the sixth Booke *De Locis Affectis*, and in his Booke *De Optimo Corporis Habitu*, saith, *That in euerie Organ there is one particle Similar, which is the principall cause of the Organically action, and that the rest are onely assistant, conferring some vse but no action*. So vision proceedeth from the Christalline humor, Sanguification from the *Parenchyma* of the Liuer, voluntarie motion from the *Flesh* of the Muscled; but the coates of the Eye, the Muscles,

Fernelius

Aristotle

A two-fold consideration of an organically part.

Galen's definition of an organ. Another.

What is a similar action

The forme of a similar part is his temper. *Galen*.

What is an organically action.

Whether the action doth proceed from the similar parts. Authorities of *Galen* to proue that they doe.

the Nerues, the two humors, do either make the Sight more perfect, or onely conferue it. Moreouer, in the fifth Chapter of his Booke *De Constitutione Artis*, he writeth, *That the action is primarily and per se, that is, of it selfe, from the Similar part; and secondarily, and by accident, from the Organicall.* Adde hereto that the Functions doe flow from the Faculties, the Faculties from the Temperament; now the Temper is the forme of the Similar part, not of the Organicall: And in the fifth Booke *De Locis Affectis*, he saith, *That the verie Essence of all the Faculties doth consist in the Temper.* In the sixth Booke *De Locis Affectis*, he saith, *That the Actions doe flow from the proper and peculiar Essence of the Parts, not from the Position: For if the Heart or the Liver should change their place, yet would they performe the actions they doe in the places wherein now they are.* And in the tenth Booke of his Method, speaking of a cold Bath: *Those that are Hellicall, that is, in a consuming and lingring Ague, are easily offended by the occursion or touch of cold water or Aire, because their Solid and Similar parts (they being more neere the Threds) are bare and naked, by which all the actions of living Creatures are performed.* Aristotle also is of opinion, that all sense commeth from the Similar parts.

Aristotle.

The explication of the question, wherein Galen is interpreted.

What we must resolve upon according to Galen.

This their deuce I must needs say is probable, but yet they trouble the pure Fountaine of Galens Philosophy. It is true, that he acknowledgeth in euerie perfect Organ one Similar particle, which is the principall cause of the action, but yet he neuer meant to referre the cause of the perfect action onely to the Temper of that Particle: So he acknowledgeth the Temper of the Christalline humor, to be the efficient cause of Vision or Sight, together with his Puritie, Smoothnesse and Scituation, which are all Organicall. For if the position of the Christalline humor be changed, if it be drowned too deepe in the glassie humour, although the Temper of it remaine neuer so exquisite, yet the vision cannot be perfect. In a word therefore I answer, that the originall of the action dependeth vpon the Similar part and his Temper, but the perfection of the action followeth the frame of the whole Organ. And this Galen teacheth in the sixth Chapter of his Booke *De Differentijs Morborum*, and in his Booke *De Optima Corporis Constitutione*, where he willet and resolueth, *That the actions doe first of all and originally issue from the Similar particles, but their accomplishment and perfection dependeth vpon the frame of the whole Organ.*

QUEST. VII.

Whether the Spermatieall parts be generated of Seed.

Three questions concerning spermatieall parts.

The first question.

The Peripateticks thinke that all the parts are generated of blood. The first Reason.

The second. Aristotle.

Having thus handled the distinction of the Parts, and the natures of them all; it remaineth that we entreat of those parts which are called Spermatieall; concerning which, there are three Questions among the rest most notable: Whether they be immediately made of the Seed; Whether they can grow together againe, or be restored, if their vnitie be dissolued; And whether they be hotter then the Sanguine or bloody parts or no; all which we will dispute in order. The first Question is hard to be determined, and therefore we must be constrained to take our rise a little higher, for that the nature of Seed which is intangled in many folds of difficulties, must first be vnfolded: Notwithstanding, because we shall haue fitter opportunitie in the Booke of the Generation of Man, to search more narrowly into the mysteries of this secret, we will content our selues in this place briefly to run ouer those things which shall most concerne the matter we haue in hand.

It is agreed vpon betweene the Physitians and the Peripateticks, that Seed is a Principle of Generation. But the Philosophers doe acknowledge it onely to be a formall and efficient Principle, the Physitians both a formall and a materiall; Formall, by reason of his Spirits; Materiall, by reason of his Body. The Physitians therefore doe determine, that the Spermatieall parts are generated out of the Crassament or thicke substance of the Seed, the Peripateticks, onely out of the Blood. This latter opinion is not without his Patrons & Abettors, and beside, supporteth it selfe by these Arguments. If the Spermatieall parts were made of the Seed as of a materiall Principle; then the actiue and the passiue, the Act and the Power; the Mouer and that which is moued; the Matter and the Forme; the Maker and the thing made should be the same; which true and solid Philosophy will not admit. Again, according to Aristotle in the second Booke of his *Physicks*, the Artizan is neuer a part of his owne Workmanship; the Seed is the Artizan. Galen calleth it

Phidias,

Phidias, who was an excellent Statuarie, and made among other Peecces *Minervas* Statue of Iuory 26 Cubits high, &c. And in the 20 Chapter of the first Booke *De Generatione Animalium*: *The Seed is no part of the Infant that is made*, saith the Philosopher; no more then the Carpenter is a part of the Wood which he heweth: neither is there any part of the Art of the Artificer in that which is effected; but onely by his labor through motion, there ariseth in the matter a forme and a shape. Moreouer, it is an Axiome of Physicke, *That we are nourished by those things whereof we are formed, framed and doe consist*; but all the parts of Man are nourished with Blood, & therefore they are all generated of Blood also.

Phidias the Statuarie.

An Axiome in Physicke. The third.

The fourth.

Hippocrates

The fifth.

The sixth.

Furthermore, if the Principall parts, the Heart and the Liuer be made of Blood (for their substance is fleshy, and *Hippocrates* calleth them both fleshy Entrals) why is it not so with the other parts which all Men admit and consent to be made and perfected after them? Adde hereto, that if the Seed of the Male be both the efficient, and the matter of the Infant, there is no reason but the Male may alone beget an Infant in himselfe: Shall the Nature of the Seed be idle and at rest, which all Philosophers with one consent doe agree, is alwayes active and operative? Finally, is it possible that so small a moment of Seed, as ordinarily sufficeth for the Generation of Man, should be sufficient for the delineation of so many hundreds, nay thousands of Bones, Gristles, Ligaments, Arteries, Nerves, Veines, Membranes, &c? Wherefore the Seed hath not the nature of a materiall, but onely of an efficient cause of Mans Generation.

There are also two places in *Galen*, which seeme to fauor the opinion of the *Peripateticks*. The first, is in the second Booke *De Naturalibus Facultatibus*, where he saith, *The Seed is an Effective Principle of the Creature, for the Materiall is the Menstruall Blood*. The other in the third Chapter of the same Booke, where he speaketh verie plainly, *There is great difference (saith he) betweene the workmanship of Phidias and of Nature. For Phidias of waxe can neuer make Iuory and Gold, but Nature keepeth not the old forme of any matter generating of Blood bloodlesse parts. As for example, Bones, Gristles, Nerves, Veines, Arteries, all bloodlesse, yet made of Blood*.

The contrarie opinion of the Physicians Authorities of Galen.

But the truth is, that *Galen* was of another mind, to wit, that all the Spermaticall parts were made of Seed, as appeareth in his Bookes *De Semine*, where he inueyeth purposely against *Aristotle* concerning this matter, teaching that the Seed is both the Efficient & the Materiall cause of their Generation. The Efficient, in respect of the Spirits; the Matter in respect of the Crassament of it. And indeed, that admirable and vnimitable Ingeny or Discourse of *Hippocrates*, did first bring this Light into the World, as appeareth in his Bookes *De Natura Pueri*, *De Principijs* and the fourth *De Morbis*. And *Aristotle* himselfe is constrained to confesse as much in the first Booke of his Physickes, and in his Bookes *De Generatione Animalium*, where he saith, *That some parts are made onely of an Alimentarie excrement, some of an Alimentarie & a Seminall together*. Besides, not to stand vpon authorities, we haue weight of Reason to proue it. The Seed of Man, is white, froathy and thicke, and when it is cast into the Wombe, if Conception follow, it is retained; for out of hand the mouth of the Wombe is so exquisitely closed, that a Needle cannot find entrance without offence.

Aristotle.

Reasons. The first

This all Women know full well; and the Muscull Housewife in *Hippocrates*, when she knew that the Seed she had receiued came not away, on the seuenth day with a *Laualto* I throw, or some such violent friske, she auoyded her Conception. For, if the substance of Seed be retained in the Wombe, it must of necessitie be resolued into nothing, or something must be made of it; or else (as the *Peripateticks* dreame) it must be dissolued into wind and vapors. The first, no Philosopher will assent vnto; for, as nothing is made of nothing, so that which is something cannot vanish into nothing. The last, *Galen* disproueth by this argument, Because when the Seed is conceiued, the Wombe is contracted, & the Seed narrowly embraced on euerie side, so that there is no place left for any distending wind: Adde hereto, that if the Seed were dissolued into wind, the Wombe being distended, whould be afflicted with exquisite torments; for of one part of Earth, are made ten of Water, and of one of Water ten of Aire.

Hippocrates Psaltria. l. b. de nat. pueri.

It remaineth therefore, that of the Crassament of the Seed, some part must necessarily be framed, and those are they which are called Spermaticall, Bones, Gristles, Nerves, Veines, Arteries, Membranes, &c. And this is prooued by their whitenesse, and by the thicknesse, and the lentor or sliminesse of their substance.

Moreouer that the Spermaticall parts are made of Seed, we may thus demonstrate: Bones, Cartilages or Gristles, Membranes and Ligaments, are bloodlesse and white, and therefore

The second.

therefore they cannot be made of Blood immediately, as Flesh; but of Blood changed, whitened & incrassated, and then what differeth it from Seed? Nature therefore should be verie idle, if she should euacuate and expell a matter fit for the generation of those parts, and (as if she had forgot her selfe) should endeavour to bring Blood into that forme of which she had at the first hand Seed enough.

The third.

To these demonstrations of *Galen* (at which *Argenterius* like a Detractor scoffeth) we will adde other Reasons. When the Seed is injected into the bosome of the Wombe, the Wombe is instantly contracted, and the Plasticall or Forming facultie thereof, rayseth vp the sleeping power of the Seed; and then his Spirits and natieue heat, commence their action. Now this action thus instantly begun, worketh vpon some-what: not vpon Blood, because yet there is no confluence of it to the part. For who will say, That in Coition there is a double Secretion, one of Seed, another of Blood at one & the same time? The *Peripateticke* himselfe will not yeeld to such a Solecisme in Nature; but we know, that that which is auoided in the act of Generation, is Seed and not Blood.

The fourth.

It is therefore the Crassament of the Seed vpon which the Spirits do worke, in which they haue their aboad, as in their proportionable subiect; this they turne and tosse on euerie side; the Dissimilar parts of it they separate, framing of the thicker Bones and Gristles, of the slimie Membranes and Vessels; all which, being scored out as the rude and first draught of a Picture, wherein are nothing but the Master-lines; the seuenth day the Blood floweth vnto it, to make the *Parenchymata* or Flesh of the Entrals, and to fill vp the vacant distances of the Fibres. If therefore in the verie conception, no Blood do flow from the Veines of the Wombe vnto the Masse of the Seed conceiued, how can we imagine, that the first delineation of the parts, is made of Blood? Againe, the Blood, where-with the Infant is nourished, and of which the *Parenchymata* are made, must passe by Veines, Veines I say, not of the Mother, for then it would encompassse the Seed onely, not insinuate it selfe into the parts of it; but of the Infant; and for this purpose is the Vmbilicall veine formed, called therefore the *Nurse* or *Foster Veine*, so that this Veine must of necessitie be made before the Blood can come vnto the Seed; and of Blood it is not made, because there is yet no affluence of it. If you shall say, that Blood is poured into the capacitie of the Wombe by the small Veines of the Wombe: I aske, why is the Infant not immediately nourished by the same Veines? what need was there that any Vmbilicall veine should be formed? Finally, another demonstration that the parts are made of Seed, may be on this manner. The Seed of the Male and Female is of one nature, colour and manner of generation, they haue both the same vessels of preparation, concoction and eiaculation, onely they are distinguished in perfection, for that the Seed of the Male is hotter and better laboured. Now all Men doe acknowledge, that the Seed of the Female is the materiall principle of the parts; why then doe they deny it to the Crassament or substance of the Seed of the Male? We therefore conclude and determine, that both Seeds are not onely efficient but materiall Principles of the Spermatieall parts.

The fifth.

The determination.

Answer to the aduerse argument. *Galen* is expounded.

Answer to the first argument.

Auerrohoes

But that we may leaue no enemies at our Backes to interrupt our victorie, as we gaine the Field before vs, let vs make answer to such arguments as are brought against the truth of this assertion. And first for *Galen*: where he writeth, that the Spermatieall parts are made of Blood, he doth not vnderstand an immediate Generation, that is, that the Bones are made immediately of red Blood, as is the Flesh; but of Blood passed through diuers alterations and mutations of Dealbation and Incrassation. And what I pray you is this, but to say they are made of Seed?

To the first argument I answer thus. There are two things to be considered in the Seed, the Spirit and the Body. In respect of the Spirit, *Aristotle* in his first Booke *De Partibus Animalium* saith, the Seed is the nature, the principle and the efficient of the thing begotten; and *Galen* in his second Booke *De Semine*, calleth it, *Formator Fetus*, the Former of the Infant. In respect of the Crassament or Body, it is called a materiall and passiue Principle, so that the same part of the Seed shall not be the actiue and passiue Principle, the act and the power, the moouer and the mooued, the matter and the forme, as the *Peripateticks* would perswade vs it must be, if that opinion were true. And *Auerrohoes* giueth an instance how these respects may be separated, so that the same thing may become the moouer and the mooued in diuers considerations. For example: In a Stone, the grauitie or weight mooueth downe-ward, and the Stone is mooued; so in the Seed, the Spirit is the moouer, and that which is mooued is the Crassament or Substance.

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In those things that are done by Art, we confesse the Artizane is no part of his owne Workmanship; but in naturall things there is not the like reason. And this *Aristotle* teacheth in the fifth Chapter of his Booke *De Spirations*. There is a difference (saith he) betwixt Art and Nature, for Art vseth heat onely as an Instrument; but Nature vseth it both as an Instrument and as a Matter. For the Fire which is vsed by the Artist to his Worke, is not a part of the Worke it selfe; but the heat, which is in Nature, is diffused thorough the substance of that she intendeth to accomplish. Some learned Men make a two-fold kind of Instrument, *wherewith* and *wherein*. The Instrument *wherewith*, remaineth not in the part which is formed: but that *wherein* remaineth, as being the subiect of the Forming facultie, otherwise there should be a formall transiſion, or transiſion of the forme, out of one subiect into another. For the Forming facultie should leaue his proper subiect, that is, the Seed, and transport it selfe into the Blood.

Answer to the second, *Aristotle.*

To the third; We doe not deny that Bones and Spermatieall parts are nourished by Blood, but that Blood hath gotten and acquired vnto it selfe the nature of Seed, in thicknesse, sliminesse and whitenesse. Or say thus. The Blood is the remote Aliment of the Spermatieall parts, and the Seed or some thing like Seed the immediate.

Answer to the third

To the fourth, The *parenchymata* or Flesh of the Principall parts, are indeed generated of Blood; but their first foundations had their originall from Seed. The Warpe is Seed, the Woofe is Blood.

Answer to the fourth

To the fifth, The Male alone cannot generate in himselfe, although he haue both Principles in him, Efficient and Materiall, because he hath no fit place for conception, nourishment and preseruatiſon of the Infant, yet therefore his Seed cannot well be said to be idle; for that is idle, which when it may or can, yet doth not worke; but in the Male it neither may nor can, because he hath not a Field to sow his Seed in; and the Seed that lyeth in the Garner, cannot be said to be doted, because it groweth not; but if it be put into the Ground, then we know it is doted if it doe not sprout.

To the fifth.

The last reason *Argenterius* makes great account of, for he taketh it to be beyond credance, that all the Spermatieall parts should be made of so small a quantitie of Seed; and therefore that he might be absurd alone, against all consent of Antiquitie, he saith, that no parts are made of Seed. But truth is, that in this there is nothing admirable, but as all the workes of God are iustly to be admired. Shall we see a Spider weaue out of her Wombe a Web a hundred times as long as her selfe, her selfe not at all lessened, and shall we thinke that Nature cannot draw as fine a Thred, and after by addition of competent matter, enlarge the dimensions thereof? But let vs returne to *Argenterius*, and see how Clerke-like he disputeth against *Galen* in this point. It is not possible (saith he) that so many Bones, Gristles, Membranes, Vessels, &c. should be all formed of so little Seed, and therefore none of them are made of Seed. A light and vaine Argument, drawne from the weaknesse of his owne vnderstanding. Doth he imagine, thinke we, that the Geniture conceived and delineated the seventh day, is by that time growne into farther dimensions then the Seed which issued from both the Parents was of? Out of doubt he was not diligent in viewing Abortments. For we dare confidently and religiously auouch, that the first moneth the *Embryo* although articulated, is no bigger then halfe the Thumbe, yea we haue seene it at eleuen weeks old not aboue an inch and a halfe long, and of the thicknesse of a good quill, though all the parts (euen of Generation) were manifestly to be seene and distinguished. If any Man shall call the credit of our asseueration into question, let him heare *Aristotle*, *Probl. 36. Sect. 1. & 7. De Historia Animalium*, where he auoucheth, *if a Male Infant of fourtie dayes growih, be put into any other thing, it will fall asunder: but if it be cast into cold water, it gathereth together, and abideth compassed as it were with a Membrane, which being broken, the Infant appeareth in the magnitude of a great Ant or Pismire, and the Members of his Body may be discerned.* What will *Argenterius* say to this? Is not the Seed of greater quantitie then a great Pismire? Let him remember *Aristotles* Philosophy, That in Principles there is great perfection, little quantitie but abundant vertue. A small Acorne into how vast an Oake will it grow? The nourishment onely is from the Earth: The extent of the parts from the vertue of the Seed. But if he will not belieue *Aristotle*, as scarcely authentick in Anatomy, we will cite him before the Tribunall of Truth it selfe, that is, of *Hippocrates*, who in his Booke *De Principijs*, affirmeth the verie same. *The Geniture in seven dayes hath whatsoever it ought to haue. For common and prostituted Strumpets, when they find they haue conceived, they vndoe it within their owne Bodies by wicked meanes, and*

To the last, *Argenterius*

An example of the Spider.

Argenterius confuted.

The small quantitie of the Infant after it is formed.

Aristotle.

Axiome. Example.

so there falleth from them as it were a flesh: Which flesh if it be cast into cold water, and diligently obserued, you shall in it perceiue all the Members, the place of the eyes, eares, hands, fingers, thighs, feet, toes, and the secret parts. If therefore in the first seuen dayes, the Infant be so small, why seemeth this vnreasonable, that of the Seed at once cast into the Wombe, the first threds and foundations of the Spermatieall parts should be formed, which afterward by the continuall apposition and assimilation of Aliment, receiue their increment and perfection?

The conclusion of the Question.

We conclude therefore, that all the Spermatieall parts are generated of the Crassament or Body of the Seed, or of a materiall Principle. And this Crassament, although it seeme at the first view homogeniall, that is, hauing all parts of it alike, yet notwithstanding containeth in it parts of vnlike natures; thinner, thicker, fatter, flimier, some fit for concretion or gathering together; others for tension and diffusion, all which are separated by the Spirits and heat of the same Seed, stirred vp by the Plasticall or Formative power of the Wombe. And so much concerning the first Question.

QUEST. VIII.

Whether the Spermatieall parts can conioyne againe after they be violated and seuered.

Proofof that the Spermatieall parts may revnite.

The first Argument.

Hippocrates, Galen, Aristotle.

The second Argument.

The third Argument. Hippocrates

The fourth. The fifth. Galen.

The contrarie opinion Authorities for it. Hippocrates

Concerning the Coalition or reioyning of Spermatieall parts, there is great contention; I know that many, as well of the ancient as latter Writers, haue and do maintaine; that they may all reioyne *κατὰ πρῶτον σκοπόν*, that is, according to the first intention, as Chirurgians vse to speake, and this they establish by these arguments. Where the Efficient, Materiall and Finall causes of Coalition are, there is nothing to hinder a Reiunction; but in young, growne and aged Men, this three-fold cause is present, therefore in all such there may be Coalition: The *Maior* Proposition of it selfe is cleere enough; the *Minor* is thus confirmed. The Efficient cause of Coalition is the Forming facultie, which vseth heat as her Instrument; this Facultie is seated naturally in euerie part, but more manifestly in the Solid parts then in the Flethy. The Matter of the Spermatieall parts is Seed, of which there is sufficient plentie, as for nutrition and accretion or growth, so also for a new generation. Hippocrates also, Galen and Aristotle doe agree, that the Seed is an Excrement, or rather Surplusage of the last concoction; now the last and most absolute Aliment is plentiful enough, neuer fayling vnlesse it be in the vtmost limit of decrepit age, and therefore the Excrement or Surplusage of it is not wanting. Moreover, according to Hippocrates, Veines, Arteries, Nerue and all Spermatieall parts haue the power of procreating Seed. Neither is the Finall cause wanting, for a broken Bone and a diuided Veine, do after a sort desire and strue to be revnited; because the solace & comfort of Nature consisteth in vnion, as her sorrow and desolation in solution. They haue also another argument not inelegant; Hollow vlcers are filled vp with new Flesh, intertexted and wouen with small and capillarie Veines, Arterie and Sinews; for that Flesh is sensible, it liueth and is nourished, therefore of necessitie by Veines, Arteries and Sinews.

Who is so mad that he dare exclude the Teeth out of the number of Spermatieall parts? But they grow againe after they be extracted. Hippocrates in his Booke *De Carnibus*, maketh a three-fold generation of the Teeth. The first from the Seed in the Wombe; the second from Milke; the third from more solid Aliments. Now if by the transmutation of the Aliment the Spermatieall parts doe encrease, why shall they not be revnited, seeing that Accretion is one of the kinds of Generation? Galen in the seuenth Chapter of the fifth Booke of his Method, and in the fourteenth of his Method, writeth, *That he hath seene many souldred and revnited Arteries*. He telleth a Storie of a young Man who had an Arterie diuided in his Arme, which afterward did perfectly revnite againe. Also in the 91 Chapter of his Booke *De Arte Parua*, and in the fifth Chapter of the sixth Booke of his Method, he affirmeth, *That the Bones of Children may revnite*. These are the Reasons which they vrge, and wherewith they goad vs to subscribe, That Spermatieall parts, euen according to the *First intention*, may revnite themselues.

Those which haue giuen vp their names against this opinion, doe labour to prooue the contrarie by authorities and by reasons. And first they oppose the 60 Aphorisme of the sixth Section of Hippocrates; *If a Bone, a Gristle, a Nerue, or the Fore-skin be cut, they neuer revnite againe*. Galen in the eighth and tenth Chapters of his first Booke *De Semine*, and also

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in the 87 Chapter *De Arte Parua*, writeth, *That the Fleſhy parts doe eaſily conglutinate, Spermatieall neuer.* And in the 91 Chapter *De Artis Parua*, He eſteemeth a *Structure in a Bone to be incurable, becauſe Bones doe not reunit according to the firſt intention.* Theſe authorities are ſeconded by reaſons: Firſt, both the Efficient and Materiall cauſes of reunit are wanting. The Efficient is the Formative facultie, which is only in the Seed, whoſe drowſie and luſking Facultie is only brought into act by the heat of the Wombe. True it is, that there remaineth in the Solid parts, a Facultie conſeruing the Figure of the Part; but to make any thing anew is proper onely to the Seed, the Efficient is wanting.

Neither is there any Matter at hand, I meane the Seed; which being generated onely in the Teſticles, how can it be transferred to the Head, the Arme, or any other Part?

Out of theſe waues and ſtormes of opinions, that we may redeeme and eſtabliſh their minds that are yet incertainly toſſed to and fro, and ſet them ſafe on Land in a quiet Harbour, we will determine the whole Queſtion by three concluſions, and theſe concluſions ſhall haue three foundations. The firſt is taken out of the determinations of *Galen*, in the 90 and 91 Chapters *De Arte Parua*, and is on this manner. There is a double reunit of diſſolued parts; *One after the firſt ſcope, another after the ſecond ſcope or intention.* The firſt intention is *ἐν τῇ ἀλλοτρίᾳ*, that is, in *Agglutination*, which we call *ἀσύνθετος*. The ſecond *ἐν τῇ ὁμοίᾳ*, that is, in *Colligation*, which we call *σύνθετος*. The firſt is ſometimes accompliſhed without any medium, that is, without ought comming betweene; as in Fleſh which being cut or diuided, is preſently glued together; ſometime with a medium of the ſame kind, which we call *medium homogeneum*. The ſecond intention is accompliſhed with a medium of an other kind, which we call *medium heterogeneum*, as with a *Callus*, *Cicatrice* or *Scarre*, & ſuch like which are not of the ſame kind with the part diſſected or ſeparated. Now that parts may reioyne according to the *Firſt intention*, and by a *homogenic medium* or meane, many things are required. Firſt, the ſtrength of the Efficient, to wit, of the Formative facultie and of the native heat. Againe, a due diſpoſition of the Matter, which muſt be plentifull, that it may ſuffice Nutrition, Accretion and a new Generation. Moreouer, it muſt be miſtred not by little and little, but together-ward, that is, it muſt be ſuddainly and an once altered, that nothing of a diuers kind may interpoſe it ſelfe betweene the diſioyned parts in the time of that alteration.

Another foundation is this, Of Spermatieall parts ſome are ſoft, as Veines; ſome harder, as Arteries and Nerues; ſome hardeſt of all, as Bones.

The third foundation, That in Infancie and Childhood all the Spermatieall parts are exceeding ſoft, and the Bones like curdled or gathered Butter, and coagulated or ſammed Cheeſe; but in thoſe that are growne to further yeeres, they become dryer, and in old Men very dry, becauſe our life is nothing elſe but a drying of the Spermatieall parts.

Theſe foundations being thus layd, we conclude thus triple-wiſe. Firſt, that Fleſhy parts are eaſily regenerated, and doe reunit according to the *Firſt intention*; but Spermatieall parts very hardly. Secondly, in Children and moyſt natures, all the Spermatieall parts, euen the Bones may reunit by a *homogenic meane*; in thoſe that are growne, ſome parts may, but not all; Veines often, Arteries more rarely, Bones neuer. In old Men there is no hope of coalition in a Nerue, Membrane, Arterie, Veine or Skin, which is called *ῥέπρωσις*; none in a Griſtle broken, eaten aſunder, torne or diſſected, which is called *χρόνις παλαιότης*; none in a Bone broken, which is called *ὀστέωσις*. Thirdly, in all ages and ſexes, euen to the vtmoſt extent of old age, all the Spermatieall parts will reunit according to the *Second intention*, that is, by a medium or meane *heterogenic*, or of a diuers kind, which in a Bone is called *Callus*, in the reſt a *Cicatrice* or a *Scarre*.

The truth of the firſt concluſion is thus confirmed: the mutation or change of Blood into Fleſh, is eaſie and expediate, becauſe it is accompliſhed by a light and almoſt ſingle and ſimple alteration. For Blood is red, hot and moyſt; ſo alſo is Fleſh red, hot & moyſt; one thing onely is required; that the Blood be increaſſated; there is therefore a fit and apt diſpoſition of the Matter. The Efficient is likewiſe verie ſtrong, becauſe Fleſhy parts are hotter then Spermatieall: Whereupon it commeth to paſſe that they ſuddainly reunit, ſometimes without any meane at all; ſometimes with a meane, but alwayes of the ſame kind and *homogenic*; yea oftentimes the Fleſh groweth ſo importunately in wounds (which we call *Hypofarchoſis*) that we are conſtrayned to inhibite and reſtraine the increaſe with *corraſſe* Liniments and Poulders. But on the other ſide, the Spermatieall parts doe verie hardly reunit according to the *Firſt intention*, becauſe of the *weakneſſe of the Efficient*, the

Reaſons.

What is to be thought.

Three concluſions, & three foundations.

The firſt foundation. A double reunit.

What are the firſt & ſecond Intentions in Coalition.

What things are required to the firſt intention.

The ſecond foundation.

The third.

The triple concluſion.

1

2

3

The confirmation of the firſt concluſion.

A three-fold cauſe why Spermatieall parts doe not reunit.

ineptitude

I
The weaknes
of the efficient

ineptitude or vnfitnessse of the Matter, and the siccitie or drynesse of the parts. The Efficient is heat, which being weake, hath enough to doe to intend conseruation and nutrition, and therefore cannot perfectly restore the decayed and vanished substance of the Solid parts.

2
The indispo-
sition of the
Matter.

It is enough (saith *Galen* in the 59 Chapter *Artis Parua*) *if it hinder them from being ex-iccated or dried up.* How shall it then laudably indeauour a new generation, when it cannot preferue them in that state in which Nature produced or brought them forth? Haply there will be a sufficiencie of Matter, but it cannot flow together-ward and at once, because the mutation or change of Blood into Bone, cannot be accomplished but by long interpolation, and many meane alterations: First into Marrow, then into Glew, and so into Seed; of red it must become white; of moyst it must become dry; of liquid it must be incrassated or thickned; in a word, it must alter the temper and all the qualities. Wherefore because the Aliment doth not flow but by little and little to the nourishment of the Bones and the Spermaticall parts; it commeth to passe, that the Excrement which resulteth or ariseth out of the nourishment, doth interpose it selfe between the disioyned parts before the Blood can passe through those diuers alterations, and so breedeth a *Callus*. There is also another impediment from the neighboring parts; as if they be Flethy, they preuent the coalition by filling vp the vacuitie or empirie space.

3
The hardnesse
and siccitie of
the parts.

The last cause of the difficultie of coalition, is the siccitie and hardnesse of the Spermaticall parts. For those things that are dry are very hardly vnited; and the Philosopher in all mixtions requireth some watery moysture, that by it as by a Glew, all the rest may be vnited.

The confir-
mation of the
second con-
clusion.

The second conclusion is thus strengthened: Children because they are not farre off from the principles of generation, haue the Efficient cause very strong and forcible: they haue abundance of Naturall heat, plentie of Spermaticall matter and that very apt, which is suddainly and easily changed, because of the softnesse and suppleness of the Spermaticall parts. In growne Men the Veines because they are soft, and beside at rest from growing and extension, are easily glued together; but the Arteries very hardly, as well by reason of their continuall motion which hindreth revnition, as also because of the hardnesse of the Coates, for they are (as saith *Herophilus*) five-fold thicker then the Veines. Some haue obserued that many parts, albeit they be lost doe neuerthelesse not revnite, because of the excellencie and necessitie of their action; for that the Creature dyeth before they can be revnited; so the Flesh of the Heart being disseuered is neuer revnited, because the Man dyeth instantly, by reason of the interception of a dutie or function of absolute necessitie for the preservation of life.

The confir-
mation of the
third conclu-
sion.

The third conclusion is so euident of it selfe, that it needeth no probation at all; for at all times Spermaticall parts doe revnite by a *heterogenie* meane. If the Skin be wounded there euermore groweth a *Cicatrice* or Scarre vpon the separation. A broken Bone is alwayes & at all times souldred with a knottie *Callus*; notwithstanding, for further illustration two Problemes or difficulties are to be cleared.

The first
Probleme.

The first, Why if a Bone be caued or hollowed by an Vlcere so as there is any losse of the Bone, the Flesh can neuer be generated ouer it? For *Hippocrates* in the 45 Aphorisme of the sixth Section, saith, *All Vlcers that are Annuall must of necessitie loose some part of the Bone vnder them, and the Scarres or Cicatrices become hollow.* Why doth not the Flesh insinuate it selfe into the hollow place of the perished Bone? Or if there be a *Callus* generated, why is there not also Flesh generated about it? I answer, that Flesh cannot be generated in the cauitie of the Bone, because Flesh is not made but of Flesh, neither a Nerue but of a Nerue; now the Lippes or extreame verges of the cauitie are bonie: What therefore shall they endeauour to generate? Surely either nothing at all, or else a Bone or a *Callus*.

The Answer
to it

If in the place of that which is lost there be no body substituted, then is there no foundation layd whereupon Flesh may arise. The Bone it selfe in dry and hard Bodies cannot be regenerated; therefore Nature not being able to doe that she would, doth that she can, so she maketh a *Callus*. But what is the reason why no Flesh can grow vpon this *Callus*? Because Flesh is a liuing and animated thing, and a *Callus* without life altogether: Now that which is animated, and that which is inanimated, that which liueth, and that which is dead, doe differ in the greatest difference, that is in the *kind* and very forme; wherefore the *Callus* which is without life, cannot be a foundation to build Flesh vpon which hath life. That a *Callus* is without life, may be demonstrated, because it is produced of the Excrement of the Bone and the neighbour parts. If it be obiected, that if it be without life

Obiection.
Solution.

Obiection.

and

and not nourished, it could not endure and grow all the time of a Mans life, which that it doth is more then manifest. The answer is at hand, It encreaseth not by Nutrition, but by apposition of the matter, as the Haires and the Nailes: Againe, it endureth as long as the Bones receiue any nourishment, from which there alwayes redoundeth an Excrement, whereby it is preserued.

Solution.

The second Probleme is, Why if the *Callus* come from the Excrement of the Bone, is it not generated in a sound Bone which also yeeldeth an Excrement? Because, when the Bone is weakened by a wound, the Excrements are more plentifully driuen vnto it from the neighbour parts; euen as all the parts that border vpon a wounded part, doe thrust downe their superfluities vnto it. And thus I thinke I haue touched, I hope cleered, all difficulties which concerne the coalition of the Spermatieall parts; it is therefore now high time to turne our discourse some other way.

The second Probleme. Solution.

But before we leaue the Field, it shall not be amisse to disparkle all the forces of our Aduersaries, that we may be said to haue gained an entire and accomplished victorie. The first Argument of the first opinion is true onely in Children; for in old Men euerie Man will confesse there is both a weaknesse of the Efficient, and a want of the Matter.

Answer to the former Obiections. To the first.

The second is a captious Sophisme, made to intrap the ignorant. For it is not necessarie that wherefoeuer there is Sense, there also should be a Nerue, for then the whole Body should be a Nerue; it is sufficient, if a Nerue be deriued vnto the part, by whose illustration and irradiation, all the particles of that part haue Sense; the same we may say of Veines and Arteries. For Mathematicall or locall contaction is not required to euerie action, but onely Physicall and Naturall.

To the second

For their third Argument, I answer, that there is not the like reason of the Teeth, and of other Bones; for the Teeth after they be drawne doe grow againe, by reason of their End, and by reason of their Matter. By reason of their End, because they are ordained to chew, mitigate and prepare the meat for the Stomacke: And therefore as they encrease euen till the end of our age for our necessitie, because they are continually wasted by attrition or rubbing one against another; so for the same necessitie they are regenerated when they faile. Beside, if you regard the Matter of their generation, there is abundance of it contained in the cavities of both the Iawes; adde hereto, that the Teeth are not incompassed with any other part which should hinder their generation.

To the third

Fourthly, they vrge, that Accretion and Nutrition are kinds of generation; but Bones doe grow and are nourished, why therefore may they not be reuinited? We answer, that this is the order and dispensation of Nature; that first the part be nourished; then, if there be any ouerplus, that the part encrease into all dimensions; and after this expence, if there yet remaine any surplusage of Aliment, that then it may goe to the restoring of the want or defect in the part; but Seed is neuer generated in that quantitie, that it should be sufficient for Nourishment, Accretion, and beside for a new Generation.

To the fourth

In the Wombe indeed the Spermatieall parts are easily generated, because both the Matter is copious, and there is moreouer; *διπλοῦς ἔργος*, a double Workman, one in the Seed, another in the Vessels, or as some thinke, in the substance of the Wombe; but after we are borne, they are hardly generated, because one of the Workmen is absent, which formerly was in the Seed, or assistant vnto it. As for the authorities of *Galen*, they doe not conclude either that all Spermatieall parts doe admit coalition, or some alwayes; and therefore we willingly subscribe vnto them, without any prejudice vnto our cause.

Answer to the authorities of *Galen*.

The Argument of the other Opinion, which denyeth the Formative facultie to the Spermatieall parts, yeelding it only to the Seed, is easily ouerthrowne; because the Seed (according to *Hippocrates*, *Aristotle*, *Galen* and all Physitians) containeth in it the Idea or formes of all the parts, which it receiueth from the Solid or Spermatieall parts. True it is, that in the Bones there is, that I may so say, a power to bonyfie or make Bones, in the Veines to veinesie, so there be an apt disposition of the Matter. But when we say that Bones are nourished, encreased, and doe revnite by Seed, we doe not vnderstand prolificall Seed, such as is apt for Generation; that is onely in and about the Testicles, where it attaineth his forme and perfection, but we vnderstand something like vnto Seed. Finally, the authorities of *Hippocrates* and *Galen*, doe conclude onely, that the harder parts cannot revnite, which thing we haue already demonstrated in the second Conclusion. And thus much of the second Question.

Answer to the arguments of the second opinion.

To the authorities of *Hippocrates* and *Galen*.

QUEST. IX.

Whether the Spermaticall parts be hotter then the Flefhy.



I were either superstition or ostentation to quote all the places of *Hippocrates*, *Aristotle* and *Galen*, wherein they anouch, that vnbloody parts are colder then bloody; but no Man that I haue read, did euer deny that Flefhy parts are bloody, and Spermaticall either without Blood, or at least but lightly moystened therewith. Vpon these premises any Man may gather the conclusion; or if they will not inferre it, it will arise of it selfe. Yet there are some among the late Writers, who would faine perswade themselues, that the Spermaticall parts are hotter then the Sanguine or Bloody. *Iobertus* sometimes the learned Chancellor of the Vniuersitie of *Mompelier* in *France*, set forth a Paradoxe concerning this matter, wherein he disputeth many things with great wit and subtiltie; some probabilitie, but lesse substance of truth, concerning the in-bred heat of the Spermaticall parts. I haue alwayes much esteemed the learning and edge of the Mans wit, yet because he is the Chiefetaine of them who haue impeached the authoritie of the receiued opinion concerning this matter; I am constrained to dissent from him, and will not thinke it presumption to examine his Arguments one by one, that the truth may more evidently appeare.

Iobertus
opinion of the
heat of Spermaticall parts.

His first
Argument:

Iobertus

The answer to
the former
argument.
Two things
to be considered
in Seed,
the body and
the spirits.

Those things (saith he) that arise of others doe sauour of the principles from whence they arise; but the Seed from which the Spermaticall parts doe proceed, is hotter then Blood; and therefore the Spermaticall parts are hotter then the Sanguine or bloody. Now that the Seed is hotter then the Blood, may thus be demonstrated. *Hippocrates* calleth Seed fierie and ayrie; Blood cold and waterish. Beside, Blood is contained in a Trough or channell, but the Seed passeth through vessels which haue no sensible cauities, which are certaine signes of the tenuitie and heat thereof. But this reason seemeth to be more washy and loose, then may answer the strength and vigor of so great a Clerkes wit. For there are two things to be considered in Seed (as saith *Galen* in many places) the craftsmanship, corpulencie as I may say, or body of it, and the spirits wherewith it is abundantly stored: In reference to the former the Seed is said to be watery & earthy; in reference to the Spirits, fierie. The Spirits are the Instruments of the Soule, by which that noble Architect formeth her Mansion or Habitation out of the Seed, working and forming it into parts conuenient. These are called forming Spirits, and in respect of these, the Seed is said to be *Artifex*, a Workeman, and carrieth the nature of an Efficient cause. The waterish and cold body of the Seed, is the matter of the Spermaticall parts. I conclude therefore, that the whole Seed considered with all his parts, is hotter then the Blood, because it is fuller of Spirits; but if the Seed be robbed of his Spirits, then is it colder then the Blood; and therefore being auoyded, the heat of it presently vanisheth, and by the coldnesse of the Ayre it becommeth liquid and blackish: and such did *Galen* acknowledge the matter of the Spermaticall parts to be.

Iobertus
his second
argument.

Answered

Iobertus
his third
argument.

This first Argument *Iobertus* strengtheneth with another, thus. The Conformation or Structure, and Scite or Position of the Spermaticall parts doe manifestly proue their heat: For the Bones occupie the in-most place, and are couered on euerie side with Flefhy, as are also the Nerves, least their ingenit or in-bred heat should vanish or be offended by the coldnesse of the ambient Ayre; but the Flefhy is placed about the vtmost parts. By which Argument I cannot see what he would conclude, for these things doe rather argue the coldnesse, then the heat of the Spermaticall parts; for because cold was their greatest enemy, that their weake and languishing heat might not be extinguished, Nature did on euerie side cherish them with Flefhy, and inuest them with Membranes for their defence. Moreover, the Bones are not seated so farre within for the preservation of their heat, but because they should serue as a stay and prop to vphold all the rest of the Frame. But if he will conclude, that the externall parts are colder then the internall, it will follow that the Skin (which all Men acknowledge to be temperate) is colder then either Nerves or Bones.

His third Argument is yet more liable to exception. The Spermaticall parts (saith he) are easily offended with the cold, therefore they are hot, for alteration is made by contraries, conseruation by things that are alike. But this is vtterly opposite to *Galen*s Philosophy,

phy, who in his Booke *De Arte Parua*, giueth this as a generall rule, whereby we may distinguish the temper of the Parts: That those which are easily offended with cold, are cold, and the hot with heat. So saith *Hippocrates*, cold is the greatest enemy to the Bones, Nerues, Teeth and Marrow of the Backe, because these parts are cold. *Galen* hath these expresse words in the 59 Chapter of his Booke *De Arte Parua*, *In all parts this is a common marke of the temperature, if the Member doe easily grow cold, it is a signe of frigiditie or raritie; if hardly, of heat or densitie; if drying things offend it, then it is dry and rasby; if moist things, then it is moist.*

Answered
Galen.

Hippocrates

Finally, *Iobertus* addeth this last Argument. That many actions of the Spermaticall parts doe testifie that there is in them a vehement and high degree of heat; so the Stomacke which is Membranous, attenuateth and boyleth the Meat though it be verie hard; yea, the Estrich softneth Iron in her Maw. The Bladder which is likewise Membranous, baketh the Stone harder then the Kidneys, which are fleshy parts. These obiections may at first sight seeme of some moment to those that are not sufficiently grounded in our Art, but we will labour to shew their weakenesse and insufficiencie. First therefore, that obiection concerning the Stomacke is full of error: For those Creatures in whom the innermost coat or membrane of the Stomacke is more fleshy, doe boyle their meat more strongly: And those Creatures which haue no Teeth, as Birds, haue a solid Flesh, and verie full of warmth annexed to their Corps; and as for Men, the inward coat of their Stomackes is lined ouer with a fleshy crust, which *Fallopins* first of all Men obserued. But goe too, let vs yeeld this vnto him, that the membranous Stomacke doth more perfectly boyle, the membranous Bladder bakes the Stone harder, yet it will not thereupon follow that the Spermaticall parts are the hotter, but that the heat when it is retained in a more solid and fast matter, burneth more powerfully. Who will say that a glowing Iron is hotter then a flame of Fire? No, it burneth more fiercely, but yet the degree of his heat is more remisse. So Fire in his owne Spheare, and in *Aqua-vite* doe not burne, because of the tenuitie and thinnesse of the matter. For the Stone, it is not generated so much by a sharpe and biting heat, as by long continuance in the part, and of the visciditie and sliminesse of the matter, as we see in old Men. Hence therefore it appeareth that the Spermaticall parts are not hotter then the Fleshy. Neither must we admit the distinction of *ingenit* and *influent* heat; because if there be a collation or comparison made, it must be betweene equals. And thus much of the third Question.

Iobertus
fourth
Argument:

Answered.

A good obseruation of
Fallopins.

Comparison

Aqua-Vita.

QUEST. X.

Whether the Solid parts being once dried, can be made moist againe.

Here is also beside the former three, another By-question, concerning the moistning of Solid parts after they be dried: For the opening whereof, we must vnderstand, that the name of a Solid part is verie ambiguous and equiuocall. The common people call that a Solid part which is firme, hard, dense or thight, and well compacted or knit together. So *Galen* calleth the Flesh of the Heart, Solid Flesh. *Hippocrates* in the seuenth Section of his sixth Booke *Epidemion*, calleth all the containing parts Solid, and thus Fleshy parts also shall be esteemed Solid. Some there are who by Solid, vnderstand all Animated parts, which haue a proper circumscription, and are bounded within their owne limits. Philosophers call that Solid, which is *ᾠλον, tale*, that is, wholly full of it selfe: So the Fire and the Ayre in their owne Spheares are said to be Solid. So *Cicero* in the first Booke of his *Diuinations* saith, That when *Alexander* determined to weare a Crowne of Gold, he made doubt whether it should be of Solid Gold, or onely laid ouer with Gold on the out-side: And according to this acception, all the Similar particles (as we haue already shewed) are called Solid, because all parts of them are equall and alike. But most properly the Physitians call those Solid parts, which are Spermaticall, as *Galen* teacheth in the first Chapter of the eleuenth Booke of his Method, and in the seuenth Chapter of his first Booke *De Naturalibus Facultatibus*, as also in the sixteenth Chapter of his first Booke *De Semine*, in all which places hee calleth Fleshy parts, Bloody, and Spermaticall parts, Solid. These Solid parts in the nine and fiftieth Chapter of his Booke *De Arte Parua*, he calleth *Primas* or the *First*; either because they are

Manifold
accepions of
a solid part.
Galen.
Hippocrates

Cicero De
Diuinatione.

Which are
properly cal-
led solid parts
Galen.

Whp they
are called
first parts.
the

Whether the
solid parts
may be moist-
ned.
Galen.

A double sub-
stance of the
solid parts
out of
Galen.
Tantum &
sale.
Quantum &
quale.

the Foundations of the rest, and as it were the first Threds and Lines which support the whole Fabricke of the Body; whereas the Flesh doth but as Rubbish fill vp the emptie spaces betweene them; or else because Seed is the first principle of the Body; or lastly, because the Spermatieall parts are generated before the Flethy. Now the Question is concerning these true and properly so called Solid parts; whether if they be reficcated and dried, they may be by Art or Nature moistned againe; that is to say, whether the Aliment that is substituted be of the same kind with that which is wasted. Galen was the Man who gaue the occasion to this Question in the 59 Chapter *Artis Parua*. *Solid parts* (saith he) *of the Body can by no meanes be made moister, it is all we can doe if we can keepe them from drying.* And in the first Chapter of the eleuenth Booke of his Method. *The quantitie of the Solid parts remaineth alwayes the same.* And in the eleuenth Chapter of the tenth Booke of his Method, *The ficcitie or drynesse of the Solid parts can by no meanes be cured.*

We imagine that this doubt may easily be assoyled, if we remember that in the Solid parts there is a double substance; one exquisitely Solid and Fibrous, altogether without Blood; another which filleth vp the distances of the Fibres, which is called the proper and peculiar *Flesh* of euerie part. The first can by no possible meanes be humected or moistned, that is to say, neither *such* nor *so much* can be restored *how much* and of *what kind* is spent or consumed. The latter may easily be restored. But least you shall thinke this distinction to be a Brat of my owne Braine, you shall heare Galen making mention of the verie same in his Medicinall Art, and in his Booke of Method. In the 59 Chapter *Artis Parua*, *The Solid parts* (saith he) *which are truly Solid and First parts, can by no possible meanes be moistned; it is as much as we can doe if we can hinder them from being ouer-soone exiccated or dried up, but the inter-middle spaces may possibly be filled with this or that moysture.* In the eleuenth Chapter of the tenth Booke of his Method, *In the Solid parts there is a Fibrous substance and there is a Flethy; so a Veine which hath but a thin Coat, hath many Fibres intertexed or wouen with it, to which the proper substance of the Veine groweth. This hath yet gotten no common name; but by way of instruction I see no reason but you may call it the Flethy-substance.* This distinction therefore is Galens owne, and therefore the fitter for vs to rest in. And so we haue gone through all the Controuersies or difficulties that concerne the nature of a Part, which we esteeme to be the proper Subiect of Anatomy. It remaineth now that we addresse our selues forward on our businesse.

(* *)

The end of the Controuersies of the first Booke.



Of the parts Inuesting, and Containing the
whole Body: And also the lower
Belly in particular.

THE SECOND BOOKE.

The Praeface.



Being now to dissolue this goodly frame of Nature, and to take in pieces this Master-piece, it shall not be amisse to take a light survey of all the parts as they lye in order, beginning with that which first meeteth with the sence. This body therefore, which indeed is but the Sepulchre of that which God at first created, although to the eye it is very specious and beautifull, yet is it but infirme and weakly defended, so that the soule is truely said *Inhabitare immunitam Ciuitem*; for to death and diseases wee lye open on euery side. The World is a Sea, the accidents and diuers occurrents in it are Waves, wherein this small Barke is vexed, tossed, and beaten vp and downe, and there is betwixt vs and our dissolution, not an inch boord, but a tender skinne, which the slenderest violence euen the cold aire is able to slice through. How then may some say, commeth it to passe, that so weake a vessell should liue in so tempestuous a Sea, should ride out so many stormes and dangers? Surely, it is put together with wonderfull Art, and framed according to Geometricall proportions, which the English Poet hath obscurely but excellently described vnder the type of the Castle of *Alma*, that is, of the soule.

The Frame thereof seem'd partly Circular,
And partly Triangular: *o worke Diuine!*
Those two, the first and last proportions are;
The one, imperfect, mortall, feminine;
The other, immortal, perfect, Masculine:
And twixt them two, a Quadrate was the Base,
Proportioned equally by seauen and nine;
Nine, was the Circle set in Heauens place,
All which compacted, made a goodly Diapase.

So that trueth to say, it is not the matter, whose commencements are dust, and con-summation clay, but the excellent proportion and structure that maketh this Paper-sconce high perill-prooffe.

We list not againe to retriue the wonders we haue already sprung, least we should seeme to mingle Yarne to lengthen out our Webbe: Our paine is as great in choise, as others is in want. For he that would summe vp all the rarities of Nature, which she hath packed together in that goodly Cabinet, had need of the Sea for his Inke, and the Sand for his Counters. It shall be sufficient in this place, to draw the Curtaine and to shew you
G the

the Case, rather the Coffin or winding-sheet wherein Nature hath wrapped this living Body of Death. Those are foure besides the Haires, wherewith as with Flowers the Coffin is garnished, that is, the Cuticle or Scarfe-skin, the Skin it selfe, the Fat and the fleshy Membrane.

The Haires are a velature or couering for the more vncomely parts, a defence for the Head, which we may encrease or diminish, keepe on or leaue off at our pleasure and for our necessitie, an ornament for the Face, and finally, a conuenient out-let and way of ex-
pence for the thicke and smoakie vapors, which otherwise would smother and choake the Braine.

The Scarfe-skin or Cuticle being void of sense it selfe, is ordained as a muniment to defend the Skin from the violence of outward iniuries; to attemper his exquisite sense, and so become the *medium* or meane of sensation; to cover the Orifices or mouths of the Capillarie and hairie or small Vessels, which determine in the Skin that the Blood issue not from them; to sucke vp the vaporious moisture which otherwise would indecently well out of the Pores of the Skin and insensibly to euaporate the same, which we call Transpiration; and finally, to turne the roughnesse and inequality of the Skin into a soft and slicke smoothnesse, and so becommeth one of the principall beauties of the Body.

The Skin it selfe is the Wall of the Castle, so quaintly framed, that the more fiercely it is besieged by the cold, the more safely it doth defend, and the more strength it doth giue to the inward parts: And therefore *Hippocrates* saith, *In winter the Belly, that is, The inward parts of the Body are hotter*; the reason is, because all the Spirits are immured, and the naturall heat restrained from vaporeing forth. But when the outward enemies are departed, then it openeth it selfe on euerie side, so cleansing the Body of such superfluities, as in the time of constraint were contracted.

Next vnder the Skin lyeth the Fat, a Pillow to the Vessels which run vnder it; a complement to fill vp the vacant distances of the Muscles, thereby making the Body plump, soft and better proportioned; a light and soft vesture to keepe the subiected parts warme in Winter and in Summer to defend them from heat. Finally, a Stowage or Magazine of nourishment against a time of Dearth: For being dissolved by the naturall heat, it melteth into a Blood-like vapor, and returneth againe into the Vessels, and so becommeth a subsidiarie Aliment in times of Necessitie, Nature being at her owne finding, and teaching vs with how little she can content her selfe.

Finally, the fleshy Membrane as an Auant-mure or inward Counter-scarfe, is ordained as a secret defence to hold out a second assault, if the outward should be won by the enemy; it preserveth also the Fat, that it is not molten with the perpetuall motion of the Muscles; it supporteth and sustaineth the passages of the Vessels, which run from within forth to the surface of the Body; and to conclude, as a Mound of Earth within a Citie, serues to make vp the breaches of the Wall, so doth this Membrane being fleshy, helpe to consolidate the Skin being wounded, or otherwise violated, which without Flesh was impossible to be accomplished. And these are the outward defences which are generall to the whole Body. There are some also more particular to the lower Belly, with which in our Anatomieall administration, we must begin according to the order of Dissection: But first we will giue you a generall view of all the regions and outward parts of the Body, calling euerie one by their names, and disciphering them in two Tables, to which we haue added also their exposition, that the young Anatomist being in the beginning acquainted with the appellations of the outward parts, may not be puzzled in the future Discourse.

CHAP. I.

A Division of the body of Man.

Dioles Caristius in an Epistle to King *Antigonus*, diuides the body of Man into the head, the chest, the belly, and the bladder. The Egyptians into the head, the necke, the chest, the hands, and the leges; we will part it into three regions, and the ioynts. The three regions are, the vpper which is the head, the middle which is the chest, and the lower which is the belly. The vpper region or the head, is circumscribed or limited by the crowne, and the first racke bone of the necke. The second Region the later writers doe call *venter medius*, or the middle belly and the chest: *Hippocrates* in his Aphorismes calleth it the vpper belly, but in reference to the lower: and the chest in his Booke *De Arte* is taken for the whole trunke of the body, for he writeth, that the *Liuier* is situated in the Chest. This second or middle Region is likewise limited by his bounds, the vpper part with the *Clauicles*, so called, because they do *claudere*, that is, shut vp the Chest; we call them patelbones: below with the brest blade and midriffe, which like a partition wall distinguisheth this middle from the lower region. On both sides it is enclosed with twelue Ribs, before with the brest bone, be-

Diuers diuisions of the body.

Our diuision. The vpper region which is the head.

The middle region which is the Chest.

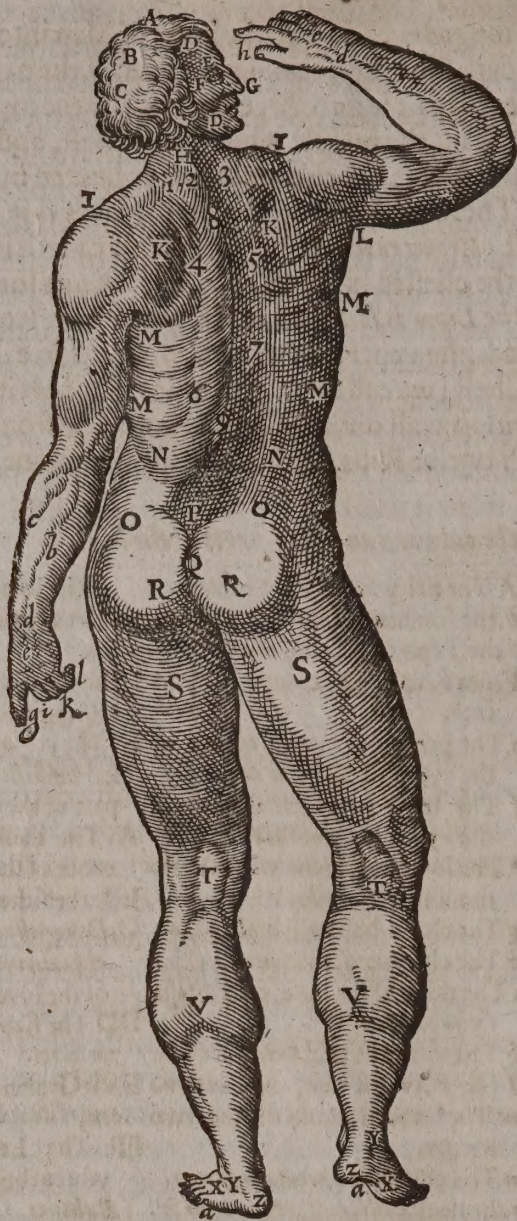
TABVLA I. The first Table, shewing the outward and fore-parts of the body.



- A The hairy Scap, cald *τρυχων*. of the lower belly.
 b the forehead cald *Frontis*, *μετωπον*. *yy*. The *Hypochondria* or *Præcordia*.
 c the Tēples cald *tempora*, *χροταφοι*.
 From b. to d. The compasse of the face. * The outward Liuer-remedies are applied to this place.
 e The greater or inward corner of the eye, cald *Canthus internus*. Z. The region of the nauill, cald *umbilicalis*, or the middle part of the lower belly.
 f The lesser or externall angle of the eye, cald *Canthus externus*. A. The nauill *umbilicus*. The roote of the belly, *ομφαλ*.
 * The lower eyebrow which is immouable, *Palpebra*. BB. the sides, *Laterra*, *πλευρα*.
 g The cheek-ball cald *mala*, *μηλα*. C. *Hypogastriū*, the watercourse *Aqualiculus*, the lower part of the lower belly, *ηλεκ*.
 h The cheek-puff cald *bucca*, *γυδα*.
 i The ridge of the nose cald *Nasus externus*, *ριν*. DD. The flankes called *Ilia* and *peccus*, *μυλινγες*.
 k The nostrills cald *nares*, *μυλινγες*.
 l The outward eare, *auris externa*. E. the Groine called *pubes* or *peccus*, *αφεις* *η* *ηβς*.
 m The mouth made of the two lips, *Os*. FF. The Leske cald *inguen*, where those tumors are cald *Bubones*.
 n The chin cald *mentum*, *γινειον*.
 o the neck, *collū*, *αυχην* *δε* *τε* *αυχην*.
 From o. to e. the pillar of the necke, *truncus*, and *δελτος*. G. the yard with the foreskinne, *peccus cum praputio*.
 pp The hollow of the necke, called *inguli*, *σφαρδα*. H. the stones or testicles, with the cod or *scrotum*.
 qq. The patell bones, *clauas*, *κλειδες*. II. the shoulders *humeri*, *επιωμιδες*.
 r. The chest *pectus*, *σενον*.
 s. The right brest. KK the arnes *Brachia*, *βραχια*.
 ss. The left brest: to this Region we apply cordiall *Epihemations* L. the bowt of the arme, called *Gibber*, *αγκων*.
 tt. The nipples of the breasts, *Papil*. M. the outside of the lower part of the arme cald *cubitus*, *πυγ*.
 la *θαλα*. N. the wrist cald *Brachiale*.
 u. The trench of the heart which the Ancients called *καρδια*. The O. the after-wrist *postbrachiale*, *μετακαρπιον*.
 The Latines *scrobiculus Cordis*. This part is anointed for the mouth of P. the Palme called *Palma* or *vola manus*, *θεναρ*.
 From u to E. the lower belly, *γαστηρ*. φ the backe of the hand *Dorsum manus*, *δποσθεναρ*.
 x. The *Epigastrium* or vpper part of the lower belly, *γαστηρ*.
 y. The *Epigastrium* or vpper part of the lower belly, *γαστηρ*.
 z. The *Epigastrium* or vpper part of the lower belly, *γαστηρ*.

QQ. the fore and middle part of the thigh, where we apply cupping glasses to bring downe womens courses, *μητρον*. RR. the knee, *genū*, *γονυ*. SS the Leg, *Tibia*, *κνήμιν*. TT. the calfe of the Leg *sura*, *γαστροκνήμιν*. VV. the instep, *tarsus*. XX, the top of the foote *Dorsum pedis*, *σηδ* *ποδός*. YY. the inner Ankles, *σφυρα*. ZZ. the outward ankles, *α* the toes of the feet. β the place vnder the inward ankle, where the veine called *Saphena* is opened.

The Second Table, shewing the outward, and
backe parts of a Man.



A. The forepart of the head, *Sinciput*, βρεγμα.
B. the top or crowne of the head *vertex*, κορυφή.
C. the hinder-part of the head, *occiput*, κολίς
κινιδόν.

From D. to D, the face, *Facies*, πρόσωπον.

E. the eyebrows *supercilia*, ὄφρυς.

F. the vpper eye-lid, βλεφαρον.

* G. the tip of the nose cald *Globulus nasi*.

H. the back part of the neck, cald *carnix*, ἀνχιγν. and
the nuke or nape of the necke, there is a hollow-
nesse at the top of this *carnix*, where we apply Sea-
tons.

I. the backe part of the shoulder top, called *axilla*,
ἄμω.

KK. the shoulder blades *scapulae*, ὠμοπλάται.

1, 2, 3. On this place we set cupping glasses.

4, 5, 6, 7. the backe *dorsum*, ὠστών.

8, 9. the ridge, *spina dors*, ῥάχης.

L. the arme hole, *ala*, μυχάλυ.

* the elbow, *Gibber brachij*.

MM M M. the sides, *Lascera*.

NN. the loynes *Lumbi*, or the region of the kidneys,
ὀσφύες.

OO. the place of the hips, *coxendices*, where wee
apply remedies for the Sciatica.

P. the place of the holy-bone, or *Os sacrum* where we
apply remedies in the diseases of the right gut.

Q. the place of the Rump or *Coccyx*.

RR. the Buttocks *Nates*, κλῶνες.

SS. the backe parts of the thigh, *Femur*,

TT. the ham, *Poples*, ἰχνός.

VV. the Calfe of the Leg, *fura*,

XX. the foote or *parvus pes*, πούς.

YY. the vtter ankle, *Malleolus externus*.

ZZ. the heele, *calx* or *calcaneus*, πτέρνα.

aa. the sole of the foote *Planta pedis*, κόλον τῆς ποδός.

b. the inside of the lower part of the arme called *Vlna*,
ῶλένη.

c. the outside of the same, *Cubitus*, πυχός.

dd the wrest, *Carpus*.

ee. the backpart of the hand, *dorsum manus*. g. the fore-
finger *index*, ἰνδύχων. h. the thumb, *pollex*, ἀνίχης.

i. the middle finger, *medius*, μέστος. k. The ring-finger *Annularis*, μεδικός, ἰνδύχων. l. the little finger, *Auricularis*, ἀνιχίς.

The third re-
gion which is
the belly.

The Ioyntss

What is con-
tained in each
region.

Why the vpper
region is bony.

Why the mid-
dle is partly
bony, and
partly fleshy.

Why the low-
er is altoge-
ther fleshy.

behind with the backe; round about, on the outside, with many Muscles, on the inside with
a Membrane which compasseth the ribs. The third Region is called the lower belly, circum-
scribed aboue by the brest blade and the Midriffe: below, by the hip-bones, the Hanch bones
and the share-bones: behind, by five racke bones of the loynes, and the holy or great bone;
and before, by the whole *Abdomen* or paunch. The rest of the body we call the Ioynts, in La-
tine *artus*, and those are the armes and the legs, which like boughes or branches, grow out of
the trunk of the body. In the vpper region, are contained the Animall organs, that is, the
braine, which is the seat of the soule, and the originall or fountaine of sence and motion. In
the middle region, are contained the vital parts, and parts seruing for respiration, as the Heart,
the Luugs; and the arteries. In the lower region are contained all the naturall organs seruing
for concoction of nourishment, expurgation of excrements, and procreation. And therefore
the vpper Region is called Animall, the middle Spirituall, and the lowest Naturall. The vp-
per is walled about on euery side with bones, as it were a strong bulwarke or Peece for de-
fence, because in it, the soule which is the Queene of this Little world, keepeth her residence
or state. The middle is partly bony, and partly fleshy: bony, for the strength of the heart, and
to frame the cavity; and fleshy, for the more facile motion of the Systole and Diastole. The
lower region is before altogether fleshy, that it might better be contracted and distended into
a greater proportion for the concoction of the aliment, reception of the excrements, and for
the containiing and increase of the infant.

In

In which position of parts who can but admire the wonderfull providence of the Creator? The Animall Region he hath set in the highest place, as well for the conueniencie of the senses (for the voice is better heard from aboue; the smell receiueth best an ascending vapour, and the Eyes which are as Scout-watches & Spies, do see furthest from aboue) as also because it was conuenient that the principall faculties of the Soule should be as farre distant as they might from the noysome vapours which doe exhale from the parts where the Aliment is concocted and the Excrements are retained. The Spirituall Region, which is the well-spring of heat and source of life, is placed in the midst, that it might diffuse his sweet influence as well into the lower as into the vpper parts. The Naturall Region, as it were the Kitchin, is built neere the ground, that the Excrements might better settle from the more noble parts, and be also more cleanly conueyed away. And this shall suffice for a brieue diuision of the whole Body, and description of the three Regions, through all which we will walke at more leasure, to obserue the diuers parts therein contained. But our perambulation shall not be in an order answerable to the dignitie of the parts, but rather Anatomicall. For they that dissect dead Bodies, doe first open the lower Region, because it is the Sinke of the Body and will soone be corrupted vnlesse the parts therein contained be taken away. We therefore from it will commence our Discourse.

Why the Animall Region is highest.

Why the Spirituall Region is in the midst

Why the Naturall is placed below.

The order of Dissection.

CHAP. II.

The diuision of the inferiour or lower Belly.

THE inferiour or lower Venter, which we commonly call the Belly, in Greeke *γαστήρ*; is almost the middle part of the Bulke or Trunke of the Body, distinguished from the Chest by the *Diaphragme* or Midriffe; and is circumscribed or bounded aboue by the Breast-blade at the end of the Brest bone, below at the Share-bone, before by that which is properly called the *Abdomen* or Paunch (for some call all the lower Belly by that name, whence those that are great gormandizers are said to be *Nati Abdomini*, that is, born for their Bellies) behind by the Spondels or Rack-bones of the Loynes, and the Sacred or Holy-bone; on both sides by the Ribs, the Bones of the Hips and Haunches. This Venter, because it was to containe the Members of Generation and Nutrition both, hath allotted vnto it the most ample cauitie or hollownesse of the whole Body. It is therefore placed below, that it might better receiue the recrements or excrements of both concoctions, and more easily and cleanly conuey them away. Before and on both sides it is fleshy, that it might be dilated or stretched out, as well for the receiuing of Nourishment, as for the containing the increase of the Wombe, or else be compressed and straightned when need shall be for the exclusion or auoiding of Excrements.

The situation of the lower belly.

Why it is placed below.

Why so fleshy.

It is diuided into two parts, the fore-part and the hinder-part; The fore-part, which *Galen* calleth *ενωδισιον*, and the *Arabians* (though their part of Anatomy we may without great detriment to our Art forget) *Mirach*, *Galen* diuideth into three parts: the *Hypochondria*, the Region of the *Naui*, and the Water-course or *Hypogastrium*: Wherefore in imitation of him we also will diuide it into the Vpper, the Middle and the Lower Regions.

How it is diuided
The fore-part
The vpper part or Region of the *Epigastrium*.

The Vpper, which is limited by the Sword-like-cartilage or the Breast-blade and the ends of the Ribs, hath three parts; two laterall or side-parts, properly called *Hypochondria*, because they are vnder the Cristles of the Bastard-ribs, for so much the Greeke word signifieth. *Celsus* by a like kind of notation calleth them *Pracordia*, because they be vnder the mouth of the Stomack, which the ancient *Greekes* called by the same name with the Heart. In the right *Hypochondrium* is placed the greater part of the Liuer; in the left, the Spleene and the greater part of the Stomacke. The third part of the vpper *Epigastrium*, which also standeth in the Front, hath deseruedly gotten the name of the whole, and is truly called *Epigastrium*, because the Stomacke lyeth vnder it, which by an excellencie is called *Gaster* or the Belly. In this place is that cauitie which the later writers call *Scrobiculum Cordis*, the hole or spoone of the Heart; the ancients called it *Cardia*. The Middle part of the *Epigastrium* is the Region of the *Naui*; it is circumscribed on both sides, with the ends of the Ribs & the right line of the Haunch-bone: it hath likewise three parts; two laterall which *Galen* calleth *κονιδιας*, i. void, because the place is without Bones: and *Aristotle* *καγδιας*, because they are lax and loose; some call them *Ilia*, we call them the Flankes. On the right side is

Hypochondria why so called.
Pracordia why so called.
Celsus.

What parts are in the *Hypochondria*.
The third part of the vpper *Epigastrium*.

The Spoone or hole of the Heart.
The middle Region of the *Epigastrium*, called the Region of the *Naui*.

The parts
contained
in it.

The lower
region of the
Epigastrium,
called the wa-
ter-course.

Dioc. Caristius

The Liga-
ments of it.
The names.
The parts
contained
in it.

The diuision
of it.

The Flankes.
The fore-part

Aristotle.
Bombones.

The Leske.
Hippocrates.
Aristotle.
The Groyne

Yeeres of
maturitie.
Hippocrates.

Priuities.

The backe-
part of the
lower belly

How it is
diuided.

Containing
and contain-
ed parts.

the Blind gut, and a part of the Collicke gut, and a part of the Emptie gut called *leinum*. The third part of this Middle Region of the *Epigastrium* is the Front, where the Nauill is seated, called *ομφαλος*, or *Umbilicus*; this is the very center of the Body, and vnder it lyeth almost all the Emptie guts.

Vnder this Region of the Nauill, is the Lower Region and third part of the *Epigastrium*, and it reacheth as farre as the Share-bone. It beginneth at the Spine or swelling of the vpper circumference of the Haunch-bone, and if you draw a Line crosse from either side vnto the Middle space betwixt the Nauill and the Spines or Protuberations of the Share-bones, you haue the full extent of this *Water-course*. Of some in a large signification it is called the Little belly, but more strictly they would haue it to be that part onely wherein the Bladder is contained, following as it should seeme *Diocles Caristius*, who diuided the Body into the Head, the Breast, the Belly and the Bladder. This Small belly is distinguished from the Greater by a certaine fence or mound, made of the production of the *Peritoneum* or the Rim: which production stretcheth from the necke of the Bladder to the backe part, and the bottome thereof euen vnto the Nauill, and this production is vp-held and sustained by three Ligaments: two of which are called the *Umbilicall Arteries*, and the third is called *Vrachus*. This Little belly *Hippocrates* calleth *Τριτον*, and *Galen Hypogastrium*, the *Latins Aqualiculus*, because the Excrements haue in it their *Rendezvous* or place of assembly: For in the fore-part it hath the Bladder and the Gut called *Ileon*, in the hinder part the Right gut, and betwixt these in Women is the seat of the Wombe. This Little belly is also sub-diuided into three parts, two laterall and a middle; the laterall reach to the place where the Haire buds, and are called by *Celcus, ilia*; because they containe the Gut called *Ileon*, and the Spermatick vessels; we call them the Flankes. The Middle or fore-part reaching to the very Yard, is properly called *Hypogastrium*; whose right & left parts which in the bending of the Thigh, side or leane to the Share-bone, are called by *Aristotle, Bombones*, (which name those tumors that arise in these parts doe yet retaine) by the *Latines, Inguina*, which is with vs properly called the Leske. The third and fore-part of this *Hypogastrium*, where the Haires grow tufted and ranke, is called by *Hippocrates* and *Aristotle, νῆς*, in *Latine, Pecten* or *Pubes*, with vs the Groyne; yet *Pubes* doth more properly signifie the Down or Cotton when it ariseth about those parts in Men, neere vpon the fourteenth yeere, in Women about the twelfth; and it is a signe of maturitie or ripenesse. For (that I may vse *Hippocrates* words in his Booke *De Natura Pueri*) as soone as the passages are open for the Seed or Monthly courses, the Haire or Downe in a Boy or Girle starteth vp, the Skin being rarefied or made thin. Vnder these are the Priuities, called *Pudenda*; the very name carrying the remembrance of our shame and of our sinne.

The backe part of the inferiour Venter or Lower belly, is limited by the end of the Ribs and the extremitie of the Rump-bone, this part some call *δίζωα*, that is, *Cinctum*, the Girdle-head, giuing the name from the vpper part; or if you will, *Subligaculum*, the Breeches, for the *Greeke* word will beare both, and then it taketh his name from the whole.

It is diuided into an vpper and an vnder part; the vpper is from the bending of the Backe vnto the Buttocks, which makes the Loynes, *Aristotle* calls them *σοφύς*: the fleshy parts on either side are called in *Greeke* *Ψόν*, *Pulpa a palpando*, in imitation whereof, we call it the Filler as it were Feele it. On the right side lyes the right Kidney, and on the left side the left. Below the Loynes are fleshy and globous or round parts diuided by a Fissure called by *Herophilus* *Σιχάλα*, by vs the Cleft. *Aristotle* calleth them *ῥοχία*, because they sustaine a Man when he sits, and we call it mannerly the Seat: He calleth them also *γυμνί*, in *Latine Nates*, *ab innitendo*, because they serue in stead of Quishions to sit vpon, we call them the Buttocks. Betwixt these is the *Coccyx* or Rump-bone, and vnder them as in a low valley, lye the verie end of the right Gut and the place of siege, the Port *Esquiline* or the Fundament.

CHAP. III.

Of the composition or frame of the Lower belly.



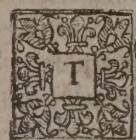
THE Inferiour or Lower belly consisteth of two sorts of parts; one called Continent or Containing and Inuesting parts, the other parts Contained. The Inuesting or Containing parts which properly make the *Abdomen*, (for they hide and conceale the Bowels or Entrals and the Guts scituated in this Lower belly, called therefore

therefore of the *Greekes* *ἐντὶ τῆς κοιλίας*, that is, about the Belly) are also of two sorts, Common or Proper. The Common, are the Cuticle or the Curtaine or Scarfe-skin, the true Skin, the fat and the fleshy Membrane; for they encompassse all the whole Body, excepting some particular parts, as we shall shew afterward. The Proper inuesting parts, are the Muscles of the Paunch or of *Abdomen*, and the *Peritonem* or the Rim of the Belly; for these are proper to the Lower belly, euerie Venter hauing his proper inuestiture vnder the Common containing parts. And of these we will intreat in order, sauing of the Muscles, which we will referre into their proper place, in the Booke of the Muscles.

The common
Inuesting
parts.
The proper

CHAP. IIII.

Of the Haires of the whole Body.



HE Haires in *Greece* are called *τριχες* *quasi* *θρίχες*, *ὅτι θρίσονται*, because we mow or poule them. *Persius* calls them *Cirri*, from the *Greece* Verbe *κίρειν*, which signifieth to cut. In *Latine* they are called *Pili*. Almost euerie liuing Creature that ingendred within it selfe, is furnished with this couering, some more, some lesse: and yet there are, which in stead of Haires, haue Pricks, as Hedge hogs and Porcupines; others haue Feathers, as Birds (and therefore the fauour of Feathers and Haires when they are burnt are alike) others Scales, as Fishes.

The names of
Haires.
*Arist. 1. Gen.
Animal. 3.*

Haires and
Feather of a
like substance.

Haires are bodies engendred out of a superfluous excrement of the third concoction, torried by the naturall heat; and they grow especially where the Skin is thinnest and most temperate, and where there is for their nourishment some proportionable quantitie of moisture. So that for their generation or production and their conseruation, foure things are required: The Heat for an Efficient cause, the Matter out of which they are generated or produced, a conuenient place for their production, and fit and competent nourishment, or rather apponed matter to be continually ministred for their preseruatiou.

Whereof
Haires are in-
gendered.

Foure things
required to
the producti-
on of Haires.

The Matter of the Haires is either remote, or more immediate: The remote Matter is a superfluous moisture, which the Kernels or *Glandules* which are disposed in the fobby and watrish places of the Body could not sucke vp, which moisture therefore is thrust out into the Skin. Hence it is, that wherefoeuer there are any Kernels, there are also Haires: and verily *Hippocrates* in his Booke *De Glandulis*, assigneth the same profit vnto them both. The *Glandules* to receiue that Matter which applyeth vnto them, the Haires to gather it in o their nourishment or for their production, being expelled by Nature as a superfluitie. So we see there are *Glandules* behind the Eares where also are Haires, vnder the Arme-pits Haires and *Glandules*, in like manner in the Flankes & the Groyne. And if in any part there be *Glandules* and no Haires, *Hippocrates* in the place next about quoted, rendreth the reason, because there is too great plentie of moisture. For we see that in fobby and sunken grounds Seed will not take root, nay the Graffe it selfe will not grow where the Water standeth continually.

The Matter.
Remote.
*Hipp. De Nat.
Pueri.*

In principio,
where are
Glandules
there are
Haires

Exceptions,
& the Reason

The next and immediate matter of Haires according to *Galen* in the fifth Chapter of the second Booke *De Temperament*, is a sootie, thicke and earthy vapour, which in the time of the third concoction, when the Aliment is turned into true nourishment of the parts, is eleuated by the strength of the action of naturall heat, and passeth through the Pores of the Skin. The Efficient cause is as we said, a moderate action of the naturall heat, which exciteth or drieth this moisture or these sootie and thicke vapors, and thrusteth them out by the transpirable passages of the Skin. For the vapour being thicke, in his passage leaueth some part of it selfe, to wit, the grossest in the very out-let, where it is impacted and by a succeeding vapor arising whence the former did, is protruded or thrust forward; and so one vapor continually solliciting & vrging another, they are wrought together into one body: euen as in Chimneys we see by the continuall ascent of Soot, long strings of it are gathered as it were into a chaine. The difference is, that the straightnesse of the passages of the Skin, where through the matter of the Haires is auoided, formeth them into a small roundnesse, euen as a wire receiue that proportion whereof the hole is, where through it is drawne.

The imme-
diate matter.
Galen.

Their
Efficient.

The manner
of their
production.

Comparison

The manner of the out-gate of this matter, is thus. When by the continuall appulsion or arriuall of such vapor to the Skin, the Pores are plenarily obstructed; then the next vapor that striveth to be at libertie, smiteth the former; which by reason of the straitnesse of

A fit Compa-
rison.

of the passage, is driuen out into the forme of a cord. He that would see an expresse Image of this manner of production, let him resort to a Glasier, when he extendeth his Metall into the guttered Lead wherein he fastneth his Glasse, and he shall perceiue how the Artift hath made an Engine, whereby an inch of Lead is driuen out, into a foot almost of length.

Hippocrates. It was necessarie therefore, saith *Hippocrates* in his Booke *De Carnibus*, that this footie excrement should haue a clammy or glewy substance, yet without any fatnesse or gresinesse at all. Wherefore, wherefoeuer in the Body, especially in the outward parts, there gathereth together any such glewy or clammy excrement, there the naturall heat bringeth forth Haires; and this is the cause why in the Arme-holes and about the Priuy-parts, yea and in all the rest of the Body Haires grow plentifully. Now that part of the Haire that is impacted in the Pores of the Skin, may fitly be resembled to the root of an Hearbe sticking in the Ground, and that which beareth out of the Skin, to the Hearbe it selfe.

There is also required a conuenient place, as a foundation wherein the roots of the Haires may be established, and that is the Skin, which of all other parts is fittest for their breeding, saith *Galen* in the first Chapter of the second Booke *De Temperamentis*, because it is neither too dry nor too moist; for as neither in Ground where water alwayes standeth, nor in Ground that is ouer-dry and worne out of heart can any thing be brought forth: so in an ouer-moist or ouer-dry Skin no Haire can grow. For though the Skin be accounted dry, yet in a Man it is not without some moisture, as it is in those Creatures which are couered ouer with a stony or crusty Shell; as Oysters, Lobsters, Crabs and such like; and in such as lurke in Dens, as Snakes; and those that haue Scales, as Fishes; in all which Haire cannot grow, because their Skins are truly and altogether dry. Moreover, the Skin ought not to be too soft and moist, like Cheese new curded; for then it would not hold the roots of the Haire because of his thinnesse; and beside, after the Pores were as it were bored by the excrement, they would fall together again, the parts being so fluid that they would run into one another and be exquisitely revnited: But it must be moderately dry to hold the Haire to his root, and moderately hard, not vnlike a Cheese already well gathered & somewhat pressed, for so it will be better thrilled and perforated by the issuing humour; which perforations also will remaine and continue, the dry Body not suffering the parts to revnite, but to consist as they are, and so by the continuall exiture of the matter, the Pores will be more neatly fistulated. Wherefore considering the whole Skin is full of Pores, whereout something is continually breathed by the naturall heat which disperseth, attenuateth and carryeth away with it selfe no small part of the inward moisture, it followeth, that in all parts of the Body the Haires may issue forth, euerie Pore hauing a Haire in it to keepe it open, for the better breathing or thrusting out of exhalations: Yet we must except the Skin of the Palmes and Soales of the Hands and Feet, because in them there is a large Tendon immediately vnder the Skin, which being exceeding thicke & dry, makes it vncapable of Haires; but I cannot admit of that reason, seeing a Hare hath also that broad Tendon, and yet hath not those parts void of Haire. Therefore we say that Nature hath made those parts hairelesse, both for vse that they might be the more sensible, as also for motion.

Now that Thinnesse of the Skin is required for the production of Haires, it appeareth by the example of Scars; for if you raise a blister by scorching the vpper Skin or Cuticle, after it is healed and the vpper Skin is growne thicke, no Haire will rise out of the Scarre, because it hath no Pores in it.

The Haires be of two kinds, some are *congeniti*, that is, *Congeniti*, bred with vs, as the Haire of the Head, of the Eye-browes, of the Eye-lids. These are bred in the Child while it is yet in the Wombe, and are resembled not vnto Hearbs that grow by sowing, but vnto such Plants as Nature bringeth forth of her owne accord; and such doe not necessarily follow the temperature of the Body.

Other Haires are called *postgeniti*, that is, *Postgeniti*, bred after the Skin is growne thin, which hapneth in Boyes when they begin to breed Seed, in Girles when their Monthly courses begin to flow; these come out in three places also; first about the Priuities, secondly vnder the Arme-holes, thirdly in the Chin and Cheekes. Those that are gelded before the age of fourteene yeeres, haue no Haires growing on their Chin: the reason is, because the wayes of the Seed are not opened, & by castration are after intercepted; and therefore the Skin doth not rarifie: If after those Haires be growne the Testicles be taken away, those Haires also fall, excepting in the Groyne. Againe, in Women those Haires which we called *Postgeniti*, doe arise later, neuer in the Chin, because there is not so great agitation of the

Hippocrates.

Comparison

The conueni-
ence of the
place for
Haires.

A dry Skin
admitteth not
Haires.
Nor a soft.

But moderate-
ly dry & thin.

Why there is
no Haire in
the Palmes
and Soales.

Why Haires
grow not vp-
on Scars.

Two kinde
of Haires.
Arst. 3. Hist.
Animal. 11.
Congeniti.

Postgeniti.

How the
Haires fall in
such as are
gelded.

the humor in the act of generation in women as can rarifie the skin so farre from the place where the seed is engendred; and yet we see, that in some women after their Courses are staide, the haire begins to bud on their chins. It may also fall out, that both men and women may be without any of the *postgeniti* by some naturall defect, contracted in their generation.

Why women
haue no beards

The forme of the haire is expressed by certaine accidents; for they do vary in thicknesse and thinnesse, hardnesse and softnesse, length and shortnesse, streightnesse and curlednesse, multitude or scarcity, as also according to the quality of the skin, and the naturall propriety or condition of the parts in which they are fixed. Moreover, they differ in colours, whitenesse and blacknesse, and middle colours between them; so also by reason of age, and growth of the body. The chiefe cause of their thicknesse and thinnesse is the skin, saith *Aristotle*, 5. gener. *Animal*. 3, which in some is thicke, and in others thin; in some rare, and in others thight and compact. Another cause is the variety of the moysture lying vnder the skin, for in some it is clammy, in others waterish: so out of a thicke skin, thicke and hard haire, and out of a thin skin, thin and slender haire are produced.

The formes
of the haire,
and the causes
of them all.
Their colours

The causes of
their crass-
tude.

And if the skin be rare and thicke, the haire is also thicke, by reason of the abundance of earthy substance, and the laxity of the passages. But if the skin be more thight and compact though it be thicke, they come out thinne, by reason of the narrownesse of the passages. So if the vapour whereof they are bred be waterish, because it is quickly dried vp, they grow not much in length; but if it bee clammy and glutinous, because it is not easily dried vp, they extend themselves in length. So that the cause of the length and shortnesse of haire, is the abundance or scarcity of the humor wherewith they are fed. And hence it is, that the haire of the head are the longest of all the body, because the Braine affordeth a great deale of a clammy moysture, and because the braine is bigger then the other Glandules; they are also crasse or thicke, because the skin of the heade is exceeding thicke, yet rare and containing much moysture. The haire of the head in Latine, are called *Capilli, quasi capitis pili*: in Greeke *κῆρυς*, from *καίρω*, which signifieth to cut. In men they are called *Casaries à frequenti casione*, because they are often cut; and in Women *Coma*, because they bestow great paines in combing and curling them. They are also in Women diuided by a line, which in Greeke is called *λίσσιμα*, in Latine *discrimen*, in English the *shed*. Now the haire is either straight or curled, by reason of the exhalation it selfe, or of the pores whereout they passe: Of the exhalation which beeing smoaky, by heate and drought maketh the haire curled. For that smoaky soote hath a double course, the earthy and dry part downeward, the hot part vpward; hence it boweth not downe right, but wrinkingly, because there is in it but little moysture and much dry and earthy matter; and this we may perceiue, if we parch haire in the Sun, or neare the fire; for the crisping of the haire is as it were a kinde of convulsion because it wanteth moysture; or else we may say, the haire curleth by reason of the drynesse of the temper; and therefore all Black-Moore haue curled or crisped haire.

Of their
length.
The haire of
the head are
the longest:

The names of
the haire of
the head.

The causes of
the streitnesse
or curling of
the haire.

Secondly, by reason of the constitution of the pores wherein the haire are implanted. For when the exhalation is so weake, as that it cannot make a straight way for it selfe, it giueth a forme to the pore answerable to it owne contortions. But if the exhalation be strong enough, yet cannot ascend directly vpwards by reason of the hardnesse of the skin, then it turneth side-long, like as we see the smoake and the flame when it is hindred to mount streight vpwards, diuideth it selfe and turnes aslant. Wherefore both by reason of the imbecility of the exhalation, and of the hardnesse of the skin, the roots of the haire grow awry. Now it standeth with good reason that they should grow and continue still such as they were framed at the roote. For no hard or dry body can be extended streight fourth, vnlesse it be first softened and mollified.

Of Curling

Comparison.

Those that haue abundance of moisture, and the pores streight, haue their haire also streight. Again, long haire is soft, but the curled are hard. Moreover, haire encrease and grow more or lesse according to the Nature of the skin, and the condition of the parts where they are implanted. In the head they grow in greatest length and abundance, next in the Beard, because that is moderately hot and dry, especially when the haire are fine and slender. But the haire of the eye-browes and of the eye-lids, are small and grow not almost at all; but for the most part, keepe alwaies an equall magnitude, and seldome fall, because they haue vnder them a hard body, like vnto a gristle. For those haire that spring from soft and moderately moyst parts, encrease very much, as those of the head and the beard;

Of streight
haire.

The Beard.

beard : and *Galen* addeth those of the arme-pits, and about the priuities : but those that arise out of hard and dry places, are small and almost of no growth : yet in some the eye-browes grow so hairy in olde age, as that they are constrained to cut them, or else they would offend their eyes. Haire buddeth in the chin, when the skin beginneth to rarifie or grow thin ; the matter of it is a moysture sent thither from the head, as *Hippocrates* holdeth in his Booke *de Natur a pueri*, and these haire make the Beard, which is not alike in euer man ; for some about their chin and lips haue great store of haire, some haue no haire there, but very much on their cheekes.

Aristotle in the third Booke *de Histor. Animal.* the 11. chapter saith, that the haire vse to grow extraordinarily in some diseases, especially in consumptions, we may adde the *Plica Polonorum*; he addeth also, in old bodies and dead corpes they receiue augmentation both in length and thickeffe, but do not spring a new.

The causes of the colours of the haire.

*Hippocrates.**De Nat. pueri.*

The humour.

Galen.

When Blacke.

Reddish.

White.

They vary likewise in colour, and are answerable to the predominant humor, for such as the humor is which the flesh draweth vnto it (saith *Hippocrates*,) such also is the colour of the haire.

Galen in his second Booke *de Temperamentis*, and the fift Chapter, saith, that the haire becomes blacke, when the vaporious excrement scorched by the heate is changed into a perfect soote ; and somewhat red, when the excrement impacted in the passage is not yet altogether growne black ; but yellow, when the vapour is lesse scorched ; for the excrement that is so impacted, proceedeth of yellow and not of blacke Choller. White haire are made of Flegme, and the colours betwixt these of a mixture of Flegme and choller.

Why mens haire are not of the colour of their skin.

But a question may be asked, why in Beasts the colour of the haire followeth the colour of the skin ; and in men it is far otherwise ; for the whitest men and women, haue often haire coale blacke. *Aristotle* maketh answer 5. *de generatione Animal.* 3. and 3. *Histor.* 11. Because, saith he, a mans skin is thinner then the skin of any other Creatures of his magnitude ; and therefore the skin cannot afford any matter of haire of it selfe, or retaine the excrement driven to it so long as to giue it his owne colour.

The Region.

The haire varieth also by reason of the region and the diuerse dispositions of the ambient ayre ; so those that inhabite a hot and dry country, haue hard, blacke, dry, curled and brittle haire, and of small growth, as the Egyptians, Arabians and Indians : contrariwise those that inhabit in a moyst and cold climate haue soft haire which grow moderately, are small or fine, straight and reddish, as the Illyrians, Germans, Sarmatians and al the coast of Scythia, as *Galen* saith. But such as inhabit a temperate tract between these, haue hayre of greater growth, exceeding strong and somewhat blacke, moderately thicke, neither altogether curled, nor altogether straight.

How haire alter according to ages.

They vary also by reason of age; for little childreh haue little haire, because as yet their skin hath no pores, nor any sooty excrement applying vnto it : when they begin to cotten, which is about xii. and xiiii. yeares of age, their haire are small and weake ; but as their youth growes strong, and their flourishes grow vpon them, which is towards xv. and xviii. then their haire grow many, great and strong, as well because their skin is growne full of pores, as also for that they abound with sooty excrements.

*Hippocrates.**De Nat. pueri.*

The reason of baldnesse.

Those that are well in yeares haue hard haire, because their skin becomes hard and thicke in old age, by reason of their coldnesse and siccity. So we see some men when they grow in yeares, become bald either for want of hot and clammy moisture, or because naturally and originally their skin was somewhat too dry, or else as *Hippocrates* saith, because they abound with Flegme, which being stirred in their heads by carnall copulation, and so growing hot ; when it arises into the skin, it scorcherh the roots of the haire and so causeth them to fall off, for it is an old saying *Nemo Caluus ante Coitum*. And that is the reason also why neither Eunuches nor children vse to growne balde. Now this baldnesse begins commonly in the forepart of the head, because (saith *Aristotle* 5. *generat. Animal.* 3.) it is dryest, for there the skinne lyeth vpon the bare-bone, without any interposition of fatte, as it is in the Nowle.

Why old men grow gray.

In like manner, Men growing old become gray-headed; not by reason of drought, for we see often that many haire become gray together, but nothing can vpon a suddaine become dry ; the true cause is putrifaction for want of ventilation, and therefore those that haue their heads continually couered, grow sooner hoary then others, as *Aristotle* obserued. *Galen* in his second Booke *de Temperam.* and the 5. chapter, saith, that before the skin of the head is growne to extreame drynesse, the haire become weake for want of

3 *Hist. Animal.*

COR-

conuenient Food, and white because the nourishment wherewith they are fed, is as it were the dregges of Flegme, which in proceſſe of time remaining about the Skin, doe putrifie.

Of all parts the Temples are firſt hairie, because they are verie moyſt by reaſon of the great Temporall Muſcles which lie vnder them. Now euerie Muſcle is fleſhy, and Fleſh is moyſter then either Bone or Skin. Next vnto them, the Fore-part of the Head growes white; laſt of all, the Haire about the Priuities and the Eye-lids; but no Body growes bald in the Temples or in the hinder-part or Nowle of the Head, vnleſſe it be Women that weare it off with Wires, &c.

The Haires are fed by moiſture, therefore *Hippocrates* ſaith, they grow moſt plentifully where they find moderate moiſture for their Food, which *Aristotle* ſaith, is diſpoſed at their root; for if you plucke them vp, that moiſture is drawne vp with them: Beſides, the Haire is thicker at the root then in the reſt of his length, because it hath ſome of that moiſture newly applyed to it. From theſe humors are exhalations raiſed, & Nature turnes the thickeſt and the clammieſt of the excrements into nourishment of the Haires. Therefore when they are well fed, and with laudable Aliment, they encrease apace, and are moderately craſſe or thicke. But when they are cut, they doe not begin to grow vp againe where the Sheeres diuided them, but at the root, from whence they iſſue, and ſo they encrease and are nourished by appoſition, as the Teeth are; not by the excrements of faultie and vicious humors, but by excrements of the third concoction: Otherwiſe, they would not fall off, but rather encrease in thoſe that haue the *French* diſeaſe and the Leproſie, conſidering that in ſuch Bodies the excrements of vicious humors are exceeding abundant.

How Haires
are nourished.

The uſe of Haires in generall is foure-fold: Firſt for a couer; ſecondly for a defence; thirdly for an ornament vnto the parts vnder them; fourthly to conſume and waſt away the thicke and *fuliginous* or ſootie excrements. So the Haires of the Head which are in great abundance (for of all Creatures a Man hath moſt Haire on his Head) doe couer the Braine, and ſhelter it from ouer-much cold or heat. For Mans braine being in proportion greater and moiſter then any other Creatures, it requireth accordingly a more carefull guard and preſeruation; for that which is the moiſteſt will moſt eaſily grow hot & cold againe. And because the Braine is ſeated farre from the fountaine of heat, and neere vnto the Bones, and vnder them is not couered with any fatneſſe; the Haires are provided both to fence it, and to keepe it warme. They alſo waſt and conſume the thicker excrements; and because it is not behoofefull for vs that we keepe our Heads alike couered in all ages of our life, times of the yeere, Countreys and conſtitutions of Bodies; therefore we may fit our ſelues vnto the times, and weare them either longer or ſhorter; but if they be altogether ſhauen off, they proue the cauſe of deſluxions. The Haires of the Head haue not onely this uſe to couer the Cheekes and Chin (which Women doe with Veiles and Maskes) but alſo they ſerue for Ornament. For it is a venerable ſight to ſee a Man when he is come to the yeeres fit for it, to haue his Face compaſſed about with thicke and comely Haire. Nature therefore hath made the vpper part of the Cheeke and the Noſe without Haire, leaſt the whole Face ſhould be wild and fearce, vnbeſeeming a mild & ſociable Creature ſuch as a Man is. In Women the ſmoothneſſe of their Face is their proper Ornament; they needed no Enſigne of Maieſtie because they were borne to ſubiection. And Nature hath giuen them ſuch a forme of Body as is answerable to the diſpoſition of their mind. To conclude, the uſe of Haire is diuers, according to the ſeueral places where they are: as for example, the Haire of the Eye-browes ſerue to receiue the humour falling downe from the Head, and thoſe of the Eye-lids to direct the Sight, and ſo of the reſt.

The uſes of
the Haires.

Man hath
more Braine
then any other
Creature.

CHAP. V.

Of the Cuticle or Scarfe-skin.

THE firſt containing or inueſting part, is the Cuticle, which the *Greekes* call *Epidermis*, because it runs vpon the ſurface of the true Skin; whereof it is as it were a flowing or creamy production. For whileſt Nature in the generation of the Skin mingleth Blood with the Seed, a moiſt vapour of the Blood foaming or frothing vp, and driuen forth by the ſtrength of the heat, is condenſed or thickned by the coldneſſe of the Aire, and turned into a Cuticle or Scarfe-skin, for ſo I thinke we may properly call it.

How it is
generated.

And

Why new-
borne Infants
lookes red.

And this is the reason why in Infants new-borne, the whole Skin looketh red, the Cuticle not being yet formed for want of cold Aire; or at least not sufficiently condensed, as it is after a short time; the Aire thickning the creame or froth of the Blood, as we see in Gruell or boyling of Past or Starch, a Skin, filme or phlegme gathered together of the vaporous froth that ariseth from the thicke moisture which is by the cold Aire condensed.

It will not
grow vpon
a Scarre.

This Skarfe-skin is easily lost by attrition or scalding, and ariseth apparently from the Skin; it is likewise as easily recovered where the Skin remaineth sound (for where there is no Skin, but onely a Scar or Cicatrice, there it will not grow againe) and therefore it is no Spermaticall part, because if they perish, they can very hardly againe be restored.

Why thin.

It is wondrous thin (vnlesse it grow *Callus* or hard by continuall labour, as we see it doth in Felt-makers) that it should not dull the sense of the Skin vnder it: Yet in the Palmes of the Hands, and the Soales of the Feet, where it is continually worne and renewed againe, it is more crasse and thicke. This is that which Serpents cast euerie yeere, we call it the Slough; Men neuer, but vpon long sicknesse or poysons, or the vse of flabbering complexions. It is thighter or more compact then the Skin it selfe, whence it is, that those watery humours which are thrust out from the Center to the Circumference of the Body, doe easily passe through the Skin, but hang often in the Cuticle, and generate *Echymata*, *Phlyctides*, and those many watrish *Pustles* which are called *Hydroa*. It is altogether without Blood, because it receiueth neither Veine nor Arterie, so that it encreaseth rather by a kind of addition of matter, then by Nutrition.

The Slough
of a Snake.

The thight-
nesse of it
manifested.

The reason of
Pustles in the
Body.

The vses of
the Scarfe-
Skin.
*Medium
tactus.*
*Lib. 2. De
Anim.*
Text. 114.

Insensible it is, that it might defend the Skin vnder it from externall iniuries; as also attemper the exquisite sense of the same, and so becommeth *Medium tactus*, the *Meane of touching*. For, saith *Aristotle*, all sensation is made by some *Meane*, none by the immediate touch of the object and the instrument. Hence it is that a Man cannot see to read vpon a Booke that is layd vpon his Eye; because there wanteth the Meane betweene the object and the instrument of Sense, that is, Aire enlightned. In like manner, when the Cuticle is off, we cannot distinguish betweene one Temper and another; because the very gentlest touch of the bared Skin breedeth paine, and the sensation is confused, which is distinct when the Scarfe-skin is whole.

There is also another vse of it, to cover the open ends of the *Capillary* or hairie Veines which doe determine in the Skin: For if the Cuticle be taken off, the Skin vnder doth bleed. Moreouer, it is also a couering to the Skin, that the moisture might not indecently or vnprofitably well or issue out at all times; for in a Gall or Rub, which is called *Intertrigo* in which the Cuticle is separated, the Skin is euer moist.

Lastly, it sootheth and polisheth the roughnesse and inequality of the Skin, making it soft, supple and slicke, and so becommeth one of the greatest beauties that Nature hath giuen to the Body of Man. That I cannot but wonder at *Columbus*, who vtterly forgot the manifold vses of this Cuticle.

CHAP. VI.

Of the Skinne.

The names of
the Skin.

His substance.

Whereof it
is made.
Vesalius.
Galen.

Columbus.
Varolius.

Vnder this Curtaine or Skarfe, lyeth the true and genuine Skin which the *Greekes* call *ἡ δερμὶς*, because it may be excoriated or flayed off, so *Hippocrates* in his Booke *De Arte*; but in his Booke *De Insomnijs*, *ὑπόμνημα*; and *De victus ratione in acutis*, *εσπίριον*; and *De Ossium Natura*, *ἡ δερμὶς quasi ἡ δερμὶς*, a Band, because it compasseth and knitteth together the whole Body; in *Latine* it is called *Cutis*. It hath a substance proper to it selfe, although it be very like to a Sinew & Membrane, because it is white, will stretch, and is of exquisite sense; but it is thicker then any Membrane. It is ingendred of Seed perfectly mixed with Blood, whence it commeth to passe that by it we may iudge as well of the Spermaticall as of the Bloody parts. It seemeth therefore to be of a middle nature betwixt Flesh and a Sinew, and so *Vesalius* conceiueth it, not so abounding with Blood as Flesh, but as it were a bloody Sinew; so saith *Galen* in his first Booke *De Temperam.* Notwithstanding, in the composition the Spermaticall part exceedeth the Sanguine, which appeareth as by the colour, so by this, that being wounded it is only revmited or conioyned by a Cicatrice or scar. *Columbus* thought it was bred of the extremities or ends of the Vessels dilated; *Varolius* onely

onely of the softer Sinews, which attaining to the surface of the Body, doe there grow together into a covering, receiuing addition from the affluence of Blood; as the broad leaues of Water-Lillies arising from a slender stem, when they appeare aboue the Water, are extended into a great bredth out of a small stalke. *Galen* in the third of his Method, saith, it is bred of the dried and constringed or writhen Flesh vnder it; and that is the reason why no Haires will grow vpon Scars, because they haue no foundation for them as the true Skin hath: But it should seeme that herein *Galen*, and not he onely, but *Plato* and *Aristotle* were somewhat mistaken: For the Skin may be flayed from the Flesh vnder it, yea and between the Skin and the Flesh there are two parts (if at least they may be so called) the Fat and the fleshy Membrane.

The Skin is naturally white, but according to the humors that abound, or the bodies vnder it, saith *Hippocrates* in his Booke *De Succis*, it varieth the colour. For example: where Blood aboundeth and the Skin is thin as in the Face, there a Rosie rednesse mingleth it selfe with the white, or ouercommeth it, especially if either by heat or motion of the mind it flow to the place more plentifully; and this Blood when it is condensed or thickned by cold, maketh the Skin looke liuid or blew. In Chollericke Men the Skin is pallid or yellowish: In Melancholly swartie and blackish or dusky, but if it be defiled with vitiated humors, it becommeth yellow and blacke in the Jaundise and Morpew.

It altereth also his color, by reason of bodies vnder it; so where it adhereth or cleaueth to the Flesh, as in the Bals of the Cheekes and Palmes of the Hands, it sooner becommeth red; if to the fat, it is whiter and smoother, especially where the fat is more plentiful; but when that fat is consumed, the Skin becommeth wrinkled and looketh like a dusky shadow; as also it is liuid or blewish where greater Veines are branched vnder it. Furthermore, the Skin that it might be a kind of muniment or defence is thicke, though not so thicke as in other creatures. It cannot without extreme paine be separated from the Flesh, because the extremities or ends of the Vessels doe determine in it; whence some haue thought, that it proceedeth from those extremities of the Vessels dilated or spread into a superficies or smooth plainnesse. It is soft and of exquisite sense, by which it fore-warneth the inward parts of the approaching euill before it ouertake them.

According to the diuers vse of the parts, it is either softer or thinner, as in the Face, the Yard, and the *Scrotum* or Cod; or harder, as in the Necke, the Backe, the Legs & the Soales of the Feet; some of it is in a middle temper between hard and soft, as in the Palme of the Hand, and especially in the Fingers ends, because they are ordained to apprehend with; and beside in the Skin of the Hand, the power or sense of feeling was to be perfect, and therefore it behoueth that it should be void of all excesse, & most temperate of all others; because that which is the iudge of feeling as all other Instruments, must be free from any foraine or externall qualitie whereby the Iudgement might be preiudiced: So some part of the Skin is exceeding thicke, as in the Head; some part onely thicke, as in the Necke; some part thin, as in the Sides and Soales of the Feet, which is the reason that there Men are ticklish; some part yet thinner, as in the Palme of the Hand; and some thinnest of all, as in the Lippes.

It hath also a diuers connexion to diuers parts: For somewhere it may be easily separated, as in the vpper and middle Venter, the Armes and the Legs; otherwhere very hardly, because of the fleshy Membrane to which it is tyed by the mediation of certaine Fibres and Vessels, betweene which and the said Membrane, the fat where it is, so interposeth it selfe, that the Skin may more easily be flayed from it: But from some parts it can hardly or not at all be separated, as from the Soales of the Feet, and the Palmes of the Hand, to which it is immediately conioyned, that the apprehension of those parts may be more firme & stable. It is also very hardly separated from the Flesh of the Fore-head, and almost of the whole Face, especially of the Eares and Lippes, because of Tendons and Muscles; especially that which they call the *Broad Muscle* mingled therewith. Finally, in the Forehead it is mouable, in the rest of the Body (of a Man I meane) immouable, or for the most part: For in Beasts it is almost all wayes mouable, and they say, an Elephant can by the corrugation or wrinkling of his Skin, kill the Flyes that molest him.

It is an vnseamed Garment covering the whole Body, yet hath it certaine breaches made by Nature for her ease and reliefe, partly manifest, which are not many, and are called *Foramina* or Outlets; partly insensible, which are infinite, called *Pori*, and of vs Pores. All which serue either for receiuing in or letting out, or both as need shall require.

Plato, Aristotle

The colour felloweth the humour.

What parts of the Skin are thin and thick

The connexion of the Skin.

Where the fat interposeth it maketh the Skin more easie to flay.

Where the Skin is mouable.

The passages of the Skin.

The passages
or out-lets of
the Skin.

The *Foramina* or passages and outlets are these: about the Eyes for the help of the sight, the thwart holes of the Eye-brows; about the Eares for the hearing, that as well the diuersities of sounds might be let in, as also the Excrements or waxe of the Eares be auoyded out; about the Nofethrils for a helpe to respiration and to smelling, and the conueying away of the Mucous or slimy excrement of the Braine: the Mouth is open to receiue meats and drinckes, and sometime againe to vomit. The Nipples of the Breast ought necessarily to be perforated, that by them the Infant might sucke Milke from the Mother: the Nut of the Yard for the emission of Seed and Vrine; the Port *Esquiline* or Siege, that the noysome Excrements may be conueyed out of the Body. In Women the *Lap* of the Wombe, as well for the admission of the part of Generation, as for the bringing the Infant into the world, and to auoid the Vrine and the Monthly courses. In the Infant the Nauill that it might receiue Blood and Spirits to supply it with nourishment and life. Finally, in the Fingers ends where the *Nayles* are affixed it is also perforated, out of all which parts we haue knowne Blood to issue in a cruell disease.

The Pores.

Transpiration

The Pores are abundant like to the Pin-hoales of a Syue or Searce, as is manifest by the sweat and hayre that breathes and breakes out, in which regard *Plato* compares it to a Fish-net: and these parts are the way of transpiration, that the excrements of the third concoction which haue no other, might this way haue egress or auoydance; whence of some it is called the *Vniuersall Emunctorie* or Draught, because it receiue all the superfluities of the inward parts. These Pores are small and almost insensible, lest otherwise there should be too free a dissipation of the Spirits, yet in some Bodies they are narrower or straiter, in some wider, and such doe easily melt away in sweat, and are lesse affected with inward causes: the other sweat verie difficultly, and because the excrements are retained, doe easily incur diseases thereby.

Why the hairs
are set in the
Cuticle.

How some
Bands or ryes
in deligations
of parts be-
come bloody.

That these Pores may be kept open, Nature hath assigned to euerie one a Hayre (of which we haue spoken already) which is fastened in the Pore with a slimy white root, excepting those places where they are continually worne off, as in the Palmes of the Hands. These Pores are the cause that the *Bands* in some deligations become bloody, and sometime pure Blood hath auoided by them, as in the *English-sweat*. By these also some thinke the Spirits do poure themselves forth in profuse ioy, and the more liberall vse of Saffron & other Diaphoreticke or sweating Medicines, by both which they are exceedingly relaxed.

That this Skin may be nourished, that it may liue and haue sense, it receiue all these three common Organs or Instruments of nourishment, life and sense; Veines, Arteries and Sinewes; whose diuarcations and diuers branchings, we shall shew in fitter place in our discourse of the Vessels.

The vses of
the Skin.

The vses of the Skin are, first that it should be the immediate Instrument of outward touching, that we might be fore-warned of outward iniuries before they come to hurt the inward parts, like as the Membranes are the Organs of the inward touching or sensation. Moreouer, it is ordained to be the common and natiue Vestment or Mantle of the whole Body; a Muniment beside and a comly Ornament compassing and couering it on all sides, that the Vessels might more securely run vnder it: The Muscles and Entrails be contained in their proper places, and defended from heat and cold, and finally, the naturall heat detained from ouer-free effluxion or expence.

CHAP. VII.

Of the Fat.

The Fat,
whereof
is engendred.



HE Fat called in *Greeke* *σμηλν*, in *Latin* *Pinguedo*, in Man is bedded betwixt the Skin and the fleshy Membrane, but in Beasts it is vnder the Membrane also. It is engendred of the more oily, thin and airy portion of pure and absolutely labored and concocted Blood, distilling like a dew out of the small and capillarie Veines of the habite of the Body: which Blood is curdled by a moderate heat (for a burning heat would consume it, and a weake heat would not concoct it) and the densitie or fastnesse of the Membrane; which is the reason that Beasts grow fattest in Winter when their Skins are more condensed with the cold.

This Membrane is Nervous, thin and very fast or thight, and vnder the Skin incloseth all the

the Body, that all that oily matter rarified into vapors, which slippeth by the inward Membranes, may light vpon and cleaue vnto this, and so be turned into Fat, that nothing profitable might be lost. The manner of this worke of Nature we haue in distillations, where though the Still-head be very hot, yet because of his sadnesse or densitie, the vapors which were rayfed vp by the heat of the fire are thickned into water.

The Fat of a Man is lesse white then of any other Creature; for the white Membranes by which the Blood (which is his matter) passeth, doe alter it but a little, so that it becometh often yellower then white.

There be some parts, there be also some ages which want this Fat; for those parts whose bending and extension it might annoy are better without it, as the Membranes of the Braine, the Eye-browes, the Yard, the Cod and the Stones or Testicles: Whereupon some haue excluded it out of the number of the Containing or Inuesting parts. In those parts where it is, it differeth in hardnesse and softnesse; for in parts that are to be moued more violently, it is harder and wouen with Fibres and small Veines; as in the Palme of the Hand, the inside of the Fingers-ends (where there is more need of it to moysten the manifold Tendons and Vessels that there are gathered, to fill vp the emptie spaces and make the Skin more euen & equall for better apprehension) the Soale of the Foot especially in the Heele, that we might more steadily rest vpon it. Sometimes it is alone, sometimes together with a crassie and slimy humor, which stands in stead of Tallow to fit the parts better for motion and to hinder their exsiccation or drying.

In other parts it is softer and yellowish; so it is very sparingly affixed to the out-sides of the Hands and Feet: In the Buttocks because there is more vse of it, it is more copious or plentifull. In cold and moyst Bodyes, as in Men and Hogges it is abundant (whence *Galen* saith that a Woman is fatter then a Man) as also in them that lead an idle and sedentary life. In hot and dry, as Apes and Hounds, it is either none at all or of no quantitie. In new-born Creatures none at all; in those that are consumed with Famine, with Disease, or with Age verie little.

This Fat which in horned Beasts is called *Seame*, in Swine *Lard*, differeth from the *Grease* which in *Greece* is called *siap*, in *Latine* *Adeps*, as *Aristotle* and *Galen* teach; because this Fat is softer and moyster, and is easily melted, and being melted doth not easily clod together againe; but the *Adeps* or *Grease* is harder and dryer, not so easily melted, and suddainly congealed againe, and therefore is more plentifull in those Creatures whose natures are altogether earthy and dry, and those that are more moyst haue abundance of the Fat we call *Pinguedo*. Men haue much of this Fat vnder their Skin, because the matter of it is retained by the soliditie and thicknesse of the same, for so we see that those Creatures that haue the fastest Skins are the fattest, as Swine and Dolphins. Now the *Adeps* or *Grease* in a Man is in his Kall, Kidneys, Heart, Eyes, the Ioynts of the Bones, betwixt the broad Tendon and the Skin of the middle of the Palme of the Hands, in the inside of the Fingers and the Toes.

The vses of this Fat are: First, It is a defence to the parts to which it is allowed, so in the Buttocks it serueth vs in stead of a Quishion; in other parts it auaieth much towards their naturall position and free motion, and therefore in those that be Fat indeed, it lyneth the inside of the Muscles as we see in fat Beefes. For the Vessels that run vnto the Skin it is a soft Pillow, so safe-guarding and moystning them, that they be not dried and so distend, or lying bare be broken in peeces; and therefore it is gathered plentifully in those parts where the larger Vessels diuide themselves.

Another vse of it is, to fill vp the emptie distances betwixt the Muscles, Vessels, and the Skin, that so the Body might be plumpe, equall, soft, white and beautifull. Moreover, it serueth for a light couering to warme the Body and to cherish the naturall heat, prohibiting the effluxion of it by his visciditie or sliminesse, and by his thicknesse closing the Pores, that neither in Winter the cold should too freely enter, nor in Summer the heat too frankly euaporate. Finally saith *Galen* in his fourth Booke *De Vsu Partium*, and the eleuenth Chapter, in great Famines and want of sustenance, it is conuerted into Aliment, and becommeth the Fother whereon the naturall heat relieueth it selfe. For being dissolved it acquireth the forme of a Blood-like vapor which returneth into the Veines, and so becommeth for want of better, a subsidiarie nourishment of the parts. The vse of the *Grease* is to moysten and supple the hot and dry parts, as the Heart, to make the motion more glib and agile, and to keepe the Ioynts of the greater Bones and the out-side of some Ligaments, from being exiccated, as also the ends of the Gristles.

What parts
and what ages
haue least Fat.

Where it is
hard and
where soft.

*Lib. 14. Vsu
Partium.*

The differen-
ces of Fats.
*3. Hist. Anim.
17. Lib. 3. De
Facult. Alim.
11.*

Where *Adeps*
is in Men.

The vses of
the Fat.

The vses of
Adeps.

The Third and Fourth Table shew the Skin-Veines which are opened and scarified: the third those on the Fore-side, the fourth those on the Backe-side: which Veines are for the most parts alike in every body, especially those that use to be opened.

TABVLA. 3.

TABVLA. 4.



1. 1. The second of them, which in the bought of the arme is ioyned with a branch of the liuer veine, and their coniunction is marked with the figure 3.

1. 2. The third is carryed side-long about the radii, and the vpper part of the arme beflowing branches vpon the skin, the chiefest of which neere the bought of the arme runeth outward, but turnes ouer neere the wrist, and there meeteth with the Liuer-vein, marked there in the second figure with a* and a little lower being diuersly deuided nourisheth almost the whole hand.

1. 3. The Liuer veine called *Hea uica*, *Basilica* or the interall veine it is called of some, & in the left arme *Lienaris* or the spleen-veine.

1. 4. A branch from the Liuer-veine deuided into two, nourishing the skinne within and without.

1. 5. A branch going to the muscles of the vpper arme, and the skin on the vpper side.

1. 6. The fore branch of the Liuer vein, which at the bought of the arme is ioyned with a branch of the *Cephalica* marked with v, AA. 2. Branches coming from the veins which two branches make the middle veine named *Mediana*, noted with 3.

1. 7. A branch arising from the former, and passing to the wrist, and on the after wrist meeteth with a branch of the *Cephalica* which are ioyned about the little finger, which coniunction we noted in f. above.

1. 8. Two fore veins of the *Cubite* or lower arme from a branch of the Liuer veine, which being accompanied with nerves, run al along euen through the hand, these where they are marked are sometimes opened in-

Read of the Liuer veine.

3. 1. The middle or common veine made of the branches of the *Cephalica* or head-veine and *Basilica* or Liuer veine.

4. 1. 2. The diuision of this common veine a-boue the wrist, which from 3. to 4. is called the *co non* vein of the cubite or lower arme: but at 4. it is deuided, one part going to the outward side, anyther to the inside and so minglith it selfe with the neighbour veins: this veine is not opened.

5. 2. The outward branch of this partition which watereth the backe of the hand.

6. 2. A branch of the common veine which vnder the thumb is opened for the *Cephalica* or head veine.

7. 2. The veine called *Saluatella*, a branch of the *Cephalica* and *Hepatica*, which about the little finger is opened for the spleen and diseases thereof.

8. 2. A veine between the middle and the ring fingers, which some take to bee that which *Auicenna* calleth *fole*.

9. 2. A branch toward the ring finger.

AA. 2. Branches coming from the veins which about the loynes are produced knottily, these in the loynes are scarified.

B. 1. Branches proceeding from the *Epigastrica* veine, distributed to the four paire of muscles of the *Abdomen*, a notable branch of which is wounded often, when men are cut for the rupture.

CC. 2. Veines coming from the vpper branch of the trunk of the hollow veine called *vena cava*, and are dispersed through the muscles and skin of the buttock.

DD. 1. Veines distributed through the *pecto-*

rall muscles and the breast.

E. 1. Veines reaching to the breasts from the veine called *mammaria*.

FF. 1. Small veins coming out from the veins which are couched vnderneath and go to the chest, the p. in all of these are scarified in the shoulder blades.

1. 1. Certaine small veins reaching to the outside of the belly coming from the veins of the muscles vnderneath.

G. 2. A branch that runs along by the side of the chest.

H. 1. A veine which reacheth to the shoulder, the muscles of the shoulders blade, and the glandules in the arme holes.

II. 1. The inner crural veine springing out neere the leske, goeth vnto the skin to the very foote, hauing a nerue running about him all the way.

KK. 1. Branches of the foresaid veine which by the inside of the thigh, reach vnto the very leske.

LLL. 1. Veines passing vnder the skinne on the fore side of the thigh.

MMMM. 1. 2. The *Crural* veine carried on the inside and outside of the thigh.

NN. 1. 2. The inner leg veine called *Tibia*, which is diuersly carried vnder the skin, and here it may bee opened when we would let blood in it.

OO. 1. The same carried vnto the fore parte of the inward ankle, and then spreadeth it selfe in the vpper part of the foote called *dorsum pedis*.

P. 2. A branch from the vpper *Crural* veine, sending small furcles to the hippe, the muscles of that place and the skin.

1. 1. 2. The outward iugular vein climbing vp the sides of the necke, this can hardly bee opened without danger, but his branches may be scarified in the necke.

b. 1. The place where this veine deuided into 2 branches.

c. 1. The inner branch of the exterior iugular, which going to the muscles of the mouth & the boy *Hyon* is couched vnder the tongue where it is opened in squinches and other diseases of those parts.

d. 1. 2. The vpper branch of the same external iugular that goeth to the back-part of the head.

e. 1. Branches going to the buccae, cheekes and the nose.

f. 1. 2. The fore-head veine, which in the middle of the fore-head where it is wont to bee opened, ioyned with the branch of the same veine on the other side.

g. 2. The veine called *vena pappi*.

h. 2. Veines dispersed along the temples, to which are adioyned portion of the fore-head veine.

i. 1. 2. The veine which goeth to the eares, and watereth the back-part of the head.

k. 1. A branch coming from the vpper part of the axillary vein and going to the more backward muscles of the necke.

l. 1. 2. A branch from the *Cephalica* or head veine, going to the skin and the muscles which lift vp the arme.

mm. 1. 2. The *Cephalique* head or vpper-veine, which passing along the vpper part of the arme accompanied with a nerue, and opened commonly at the vpper bunch of the bought of the arme, but happily it might more safely be opened a little lower where it bendeth from the sinew.

n. 1. Small veins from the *Cephalica* dispersed through the skin of the arme.

o. 2. Branches from the head veine to the shoulder blade, carried betwene the skin and the flesh.

p. 1. The *Cephalica* is here deuided into 3 branches.

q. 1. The first of these branches which goeth to the muscles, arising from the vpper bunch or knot of the vpper part of the arme called *humerus*.

Q. 1. A branch noted with 7, and 9, which befloweth certaine furcles vpon the muscle of the leg, and the skin of the thigh.

RS. 1. A veine from the ioyning of the branches of that other, which passeth to the back muscles and skin of the thigh somewhat vpperward.

TT. 2. The *Ham-veine* *vena popheis*, which runneth most where it is marked, and passeth vnto the calfe of the legge marked with V. 2. where it deuideth it selfe into many branches.

XX. 1. The inner branch of the crural veine going to the muscles and skin of the calfe.

Y. 1. The inner veine of the legge running to the inner side of the foote accompanied with a nerue, this they open vnder the knee instead of the *saphena*.

ZZ. 1. 2. A part of the crural veine going to the backside of the inner ankle: this is called the *saphena*, and is opened vnder the inner ankle in women most what to further their naturall euacuations.

aa. 1. The outward branch of the crural veine or the vpper leg-veine called *Tibia*, which is diuersly branched againe along the outside of the leg and the top of the foote.

C. A part of the foresaid branch climbing along the outward ankle.

yy. 1. Among the veins of the foote, this is that which vnder the name of the *Cephalica* is opened at the great toe, but not without danger, because it hath a nerue ioyned with him.

CHAP. VIII.

Of the Flefhy Membrane.

THE Flefhy Membrane (first fo called by the *Arabians*) or Pannicle, called *Panniculus Carnosus*, in *Greece* *ὑμνὸς ἀρκαδῖος*; is onely flefhy among all the Membranes, and that especially in Beasts. *Galen* calls it *ὑμνὸς*, that is, a Membrane; some call it the Musculous Membrane, because in those Creatures which moue their whole Skin, it is fo be-sprinkled with flefhy Fibres, that it seemes indeed to be a Muscle.

This Membranous part, as all other Membranes, is made of Seed. In a Man it is vnder the Fat, but in Apes, Dogges, Sheepe and such like, it lyeth immediately vnder the Skin. It compasseth the whole Body, and closely cleaueth to the Skin by the mediation of many Veines, but fewer Nerues and Arteries diuersly propagated, and through it climbing vp thither, whereto also helpe the addition of flefhy Fibres. It cleaueth also to the Membranes of the Muscles vnder it, but by more slender Fibres. It is said by some to haue his originall from the Backe, because it cleaueth there most inseparably, and there resembleth the other Membranes; but where it toucheth the Arme-holes, it becommeth in Dogges and Apes very Flefhy, *Galen* saith Musculous.

In Infants it resembleth Flesh altogether, because of the abundance of Blood wherein it is sleept; in growne Bodyes by reason of continuall exiccation, it becommeth like a Membrane, yet so, that in the fore-part of the Necke and in the Forehead, it cleaueth to the Flesh so fast with his flefhy Fibres, that it can vneath be separated, and to the broad Muscle, that it is thought to giue him his Body. It is in a Man (except in the Forehead) immouable; in Beasts it is not onely mouable it selfe, but also maketh the Skin mouable, especially in the Necke, by shaking whereof they driue away the Flyes, but a Horse in shaking of his Skin, will sometime shake an vnskillfull Rider out of his Seat. In the inner part which is next to the Membrane of the Muscles, this flefhy Panicle by reason of a slimy moysture wherewith almost all Membranes are couered, is slippry, that it may not hinder the motion of the Muscles, and it hath an exquisite sense, so that if it be goaded by any sharpe humor, it causeth a rigour or shiuering. The vses of this Membrane are: To compass the whole Body, to couer and defend it: To hinder the Fat from being melted by the continuall motion of the Muscles. It supporteth also, saith *Galen*, 3. *Administrat. Anat.* 2. the Vessels which attaine vnto the Skin, because there passeth betweene it and this Membrane, not only many Capillary and thredty Veines, but also those which we vse to diuide in Blood-letting, together with many Arteries and Sinnews. Finally, it helpeth to consolidate or heale vp the Skin when it is wounded or otherwise violated; for without Flesh it cannot revnite, so saith *Aristotle* in his third Booke *De Historia Animalium*, 11. *wherefoener the Skin is without Flesh, there it cannot revnite being diuided.* In bruit Beasts, the thickenesse and fastnesse of this Membrane, retaineth the bloody vapors, and turneth them into good Blood, and besides it maketh their Skins mouable. And thus much of the Common Containing or Inuesting Parts. But because we made mention euen-now of the Veines which run betweene the Skin and the Flefhy Membrane, which are vsually many of them opened in Phlebotomy; and for that young Chirurgions had need be betimes acquainted with them, we haue here added two Tables and their expositions at large, by which he that listeth may in one view see all the branches of the Skin-Veines how they are seated, and beside learne to call them by their names, that when he is commanded, he may know how to buckle himselfe to his businesse in opening or scarifying of them.

CHAP. IX.

Of the Inuesting or Containing Parts, proper to the Lower Belly.

THE proper Containing Parts whereby the Lower Belly is inuested, are the Muscles of the *Abdomen* or Paunch, and the *Peritonaeum* or Rim of the Belly. The Muscles are in all Bodies alwaies eight, foure on either side, matched equally in Figure, Magnitude, Strength and Action. Of these there are foure Oblique,

The flefhy Membrane:

The connexion of it.

Gal. 1. Admin. 6. s. eiusd. 7.

Where it is mouable in Men. In Beasts.

The vses of it.

Galen.

Aristotle.

Eight Muscles of the Paunch

two Right, and two Transverse, all of them have these appellations from the situation and the texture of their Fibres. In Dissection the Oblique externall paire doe first offer themselves, which are the broadest of all the rest. Next follow the Oblique internall; the Anatomists do usually call the former Oblique Descendents, the latter Oblique Ascendents, but how properly or improperly we shall shew hereafter. Next to these follow the two Right Muscles, in whose inward parts doe appeare those Veines ascending and descending, which conioyne about the Nauill. Vnder all these lye the two Transverse Muscles.

Two other
Muscles lately
found out.

There are also in some Bodies two other small Muscles called *Succenturiati* Assisters, or *Piramidales*, that is, the Spiry-Muscles. The Historie of all these Muscles, as also the Controversies and diuers opinions concerning them, we will at large prosecute in our Booke of Muscles, whether for satisfaction we referre the Reader.

Peritonaeum
or Rim of the
Belly.
The Umbili-
call Vessels.

Next vnder these lyeth the *Peritonaeum* or Rim of the Belly, a thin Membrane like vnto a Spiders Web, which enwrappeth all the inward parts in this Venter contained. Towards the Bladder especiall it is evidently duplicated, betwixt which duplication those Vessels which the Ancients call *Vasa Umbilicalia*, the Vauill Vessels are carried. Of all which it followeth now that we should entreate, beginning with the *Peritonaeum*.

CHAP. X.

Of the Peritonaeum or Rim of the Belly.

The Rim of
the Belly or
Peritonaeum.
7. Epidem.
6. Admin.
An 4.
The names.

The Figure.
The quantitie
or dimensions
of it.

The connexi-
on.

The substance
of it.

Wherethicker
and where
thinner.

THE Muscles of the *Abdomen* and their Tendons being remoued, we meet with a Membrane ingirting the whole cauitie of the Lower Belly, which they call the *Peritonaeum*. Imitating herein *Hippocrates* and *Galen*, who giue it that name, because it compasseth all those parts which lye betweene the Midriffe and the Thighes. Or because it firmeth or strengthneth all the *Viscera* or Entrails that it containeth. The *Arabians* call it *Ziphach*, as they call all other Membranes & particularly *Charmel*, others call it the Membrane or Coat of the *Abdomen*, we call it the Rim of the Belly. The Figure of this Membrane is Ouall, or like an Egge [Tab. 5. AABCD] The greatest it is of all the Membranes of the Belly, as incompassing the greatest cauitie of the whole Body. In longitude and latitude it answereth the whole inferiour Venter. It is made of Spermaticall threds and the Mothers Blood poured betweene them, after the manner of a *Parenchyma*. It proceedeth from the Menings or Membranes of the Braine which inuest the Marrow of the Backe and the Nerues, but hath his beginning betwixt the first and the third Spondell or Racke-Bone of the Loynes; and that is the reason why there it is so thicke that it cannot be separated without tearing in pieces.

It is knit aboue (which part *Galen* 4. *De Vsu Partium* 10. calleth *Vertex Peritonaei*) to the *Diphragma* or Midriffe so strongly, that when it is enflamed the *Hypochondria* are drawne vpward; below to the Bones of the Haunch and Share; before it obstinately cleaueth to the White Line and to the Tendons of the Transverse Muscles; of it selfe alone it consisteth without connexion below the Region of the Nauill at the Share-Bones; and as it applyeth to the Region of the Nauill, it is knit to the thin Tendon of the Transverse Muscles; backward to the originals of the Transverse Muscles and to that Membrane of the Nerues proceeding from the Spondles of the Loynes (from whence some say it ariseth) and to all the *Viscera* or Entrails, to whom it affordeth seuerall Membranes.

His Substance is membranous and thin; *Galen* 4. *De Vsu Partium* 9. addeth simple, yet strong and compact, that when the Belly is full of meat, or the Wombe of the burthen, it might be without danger stretched and relaxed as wide and long as need required. Thin it is before, least it should be a burthen to the parts vnder it; yet so, that in Men it is thicker from the Sword-like Cartilage or Breast-blade as farre as the Nauill, then it is neerer to the Share; but in Women it is stronger from the Share to the Nauill, that it might better endure distention as their burthen groweth. Toward the Backe-Bone about the Loynes it is thicker, because it is to be sluied or parted into many Cobweb-like Membranes, which it affordeth to the Entrails, yet are these very strong that they might be able to containe or keepe downe windy distensions; and least in holding of breath, or when they are stretched they should be broken. On the inside it is smooth, and as it were lined with moysture, that it may not offend the smoothnesse of the Entrails, and sometime hath Grease adioyned to it (which most what accompanieth the Veines) especially about the Stomacke and Holy-Bone. On the out-side it is sharpe

sharpe or harsh and fibrous (saith *Fallopious*) that it may the better cleave to the Muscles. It is euerie where double, which yet is most conspicuous about the *Ridge*; the lower part or Membrane of this duplication, is couched vnder the hollow Veine, the great Arterie, and the Kidneys; all which the vpper and more inward part couereth, that the Vessels being on euerie side guarded and defended, might securely disperse their branches betweene those two Membranes.

The duplication of this Peritonæum

So the *Peritonæum* is doubled, where the Nauell Vessels passe through it on this manner. The two Arteries [Tab. 6. a a] arise from below to the [Tab. 6. C] Nauell; and the Veine ascendeth also from the Nauell [Tab. 6. from D to the upper B] to the Liuer. It is also manifestly duplicated in the *Hypogastrium* or Water-courie, and maketh there a large cauitie, that betwixt his Membranes the Bladder might be inclosed. To which Membrane it is also firmly connexed. [Tab. 2. Lib. 3. at *]

How and where it is perforated.

The first Figure sheweth the Right Muscles of the Lower Belly, with the Vessels, and the Lower Belly it selfe covered with the Peritonæum or Rim, all the Muscles being taken away.

The second Figure shewes the Veines and Arteries which descend from the Mammariæ vessels, and those which ascend from the Epigastricke.

TAB. V.



- A B C D. The vpper, lower and laterall parts of the *Peritonæum*.
 E E. The White Line from the Gristle of the Breast-Bone, called the Breast-Blade, to the Commissure or meeting of the Share-Bones.
 F. The Gristle of the Breast-Bone, *Costi-ago ensi-formis* or the Breast-Blade.
 G. The Nauell which, all the Muscles being taken away, must be kept for the demonstration of the Vmbilicall Vessels.
 H H. The productions of the *Peritonæum* which containe the Seminarie Vessels on either side.
 *. The hole which giueth way to the Seminarie Vessels of Men.
 I I. A Veine and an Arterie from the *Epigastricke*, which being carried vpward vnder the right Muscles, doe here hang down, and are distributed into the lower part of the *Abdomen*.
 K K. A Veine and an Arterie from the internall Mammariæ proceeding from vnder the Bone of the Breast, are carried downward thorough the right Muscles and are diffeminated into the vpper part of the *Abdomen*.
 1, 2. The place wherein the right Muscles arise, which being here cut off, doe hang downe, that their Vessels may the better be seene.
 3, 4. The *Anastomosis* or inoculation of the foresaid Vessels, making the consent of the *Abdomen* and the Nose, and of the Wombe with the Breasts, as some thinke.
 L L. Branches of Veines running into the sides of the *Peritonæum*.
 N. The place of the Haunch-Bone bared, to which the Oblique and the Transuerse Muscles doe grow.

The second Figure.

- a. The descending Vessels proceeding from the Trunke of the hollow Veine, and the great Arterie vnder the Breast-Bone
 b. The Vessels ascending from the *Epigastricke* Vessels.
 c c c. *Anastomosis* or the inoculations of the ascending Vessels with the descending.

It is perforated as the Vessels are necessarily to passe through it, but so as the Orifices or Verges of the Membrane are closed about the Vessels. Aboue, where it cleaueth to the Midriff, it hath three Perforations, one on the Right-hand for the passage of the hollow Veine. Another on the Left, that through it the Gullet might be ioyned to the Stomacke, together with the Sinnewes that cleave vnto it. A third, for the conueying through the great Arterie, the vnmated Veine & the Sinnew of the sixth paire. Below, it is perforated about the Siedge, the Neckes of the Bladder and the Wombe, as also where the Veines, Arteries

The reason of
a rupture.
Why a Testi-
cle is necessa-
rily lost in
cutting for
a rupture.

The Coates
which the
Peritoneum
giveth to all
the Viscera or
Entrals.

The vſes of
the Rim.

Galen.

Arteries and Sinnewes which are sent into the Thighes, are distributed thorow the *Peritoneum* it selfe, the Muscles of the *Abdomen* and the Skin. There are also two productions [Tab. 5. H H] on either side one, which passing from his externall Membrane seated vnder the Kidneys neere the Share-Bone, like loose Canels or Pipes, attaine through the Tendons of the Oblique and Transuerſe Muscles without the cauitie of the Belly into the Cod, and so to the Testicles, where spreading themselves, they compose or frame their proper Coat. Through which productions the preparing Spermaticke Vessels doe descend, and the *Deferentia* or leading Vessels doe returne to the necke of the Bladder together with the Muscles of the Testicles in Men. But in Women two Processes or Productions passe from the Wombe to the vpper patt of the necke of the same. To these Productions adhereth very closely the internall Membrane, which yet is disioyned neere the Share-Bone; which inward Membrane if it be broken, and the externall dilated, according as the Gut or the Kall shall fall downe either in Men or Women; so it causeth the one kind of rupture or the other. This Production (the Skin being cut in the Flanke) if it be intercepted and taken vp with a tye close to the *Abdomen*, hindreth indeed the fall of the Gut or Kall, but because the Spermaticall Vessels also in Men are necessarily tyed with the Production, the Testicle of that side must needs be vitiated and loose his vse; but if the tye be not [at * * in Tab. 5.] very neere to the *Abdomen*, then some part of the Gut falling downe, brings great moleſtation, and although there be no outward tumifying or bearing down to be seene nor scarcely any can be felt; yet it requireth a new incision & a new tye, as we haue learned at the price of other Mens experience. Finally, in the fore-part about the middle of the Belly where the Nauill is, it is perforated in the Infant for the passage of the Nauill Vessels, that it may receiue nourishment from the Mother, but afterward that Perforation groweth vp, and if it breake out againe, it causeth the Nauill-rupture called *ομφαλοκήλη*.

From this *Peritoneum* also as from their originall doe proceede particular Coats, where-with euerie Instrument vnder the Midriffe is couered, but some of the Entrals haue thinner Coats, some thicker, according to euerie ones necessitie: as the Kidneys Coat is crasse and thicke, but those of the Stomacke, Guts, Bladder and Matrix much thicker: This Coat compasseth the proper Coat of the Entrals and is called the Common Coat; the vpper Entrals as the Liuer, the Stomacke, &c. borrow it from that part of the Rim which groweth to the Midriffe: the nether, as the Bladder and the Guts, from that part which cleaueth to the Share-Bone, as saith *Galen* in his fourth Booke *De Vſu Partium*, and twentieth Chapter. There be also two Membranes which proceed from this which are double, the Kall and the Mesenterie, and some Ligaments, as the Ligament of the Liuer. Veines and Arteries the Rim hath from the neighbor Vessels: aboue from the Vessels of the Midriffe which are called *Phrenica*; behind from the Muscles which go away by the Loynes & so run through the sides [Tab. 5. L L.] of this *Peritoneum*. Before and some-what higher [Tab. 5. K K.] from the Mammarie or Pap. Vessels which trend downward vnder the Sword-like Cartilage or Brest-Blade to the right Muscles; lower from the *Epigastricall* Vessels [Tab. 5. I. I.] ascending vnder those right Muscles it receiue certain furcles or branches for his nourishment and the preseruatiō of his naturall heat; sometime also seuerall tendrils are communicated vnto it from the Spermaticall Veines. The Nerues are very threddy which it hath from them that are distributed into the Muscles of the *Abdomen* by which it receiueh sense.

The vſes of this *Peritoneum* or Rim, are: First, saith *Galen* in the fourth Booke *De Vſu Partium*, and first Chapter, to couer the parts contained in the Lower Belly; but this vse, saith he, is not the principall, because those parts are well couered beside with the Muscles of the Paunch, a great deale of Fat and the Skin. The second vse is, that it should be a *medium* or meane betweene the Entrals and the Muscles, and so hinder the Kall and the small Guts from falling into the spaces betwixt the Muscles or vnto the Skin; (as it hapneth when this Membrane is broken) where they would cause great paine, hinder the motions of the Muscles, and the free deſposition or auoydance of the Excrements; all which inconueniencies we find when this Rim is wounded and not perfectly and rightly cured. Thirdly, it helpeth much to the speedy vnburdening of the Belly; for, because the Muscles of the Paunch and the Midriffe by reason of their different ſituation, cannot in their contraction straine the whole Belly equally & alike in euerie place: the continued position of the Rim supplyeth that want, as when a Man applyeth both his Hands vpon a Bag of Hearbs and compasseth it about on euerie side, he may more equally straine the Liquor out of all the parts of the Bag. Fourthly, saith *Galen* in the Booke next aboue named, and the ſeuenteenth Chapter,

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FIG. II
A



The Nauill the

it giueth Coats to all the Entrals of the Lower Belly, and produceth diuers Ligaments, as we haue partly touched before, and shall doe more at large hereafter. Fifthly, it firmeth and strengthneth all those Entrals, especially the Stomacke and the Guts, which otherwise being distended with wind would be violated, yea torne as it were, and their Coats sliuen afunder, beside, it tyeth them together and holdeth them fixe in their proper places. Finally, it is a saue-gard to the Vessels, which hauing a long course to run, and being but slender of themselves, are secured betwixt the duplicated Membranes of this *Peritonaeum*.

CHAP. XI.

Of the Vmbilicall or Nauell Vessels.



They are called *Vasa Vmbilicalia*, because they passe through the Nauell which is called *Vmbilicus*, for of their conuolutions or fouldings one with another, is the Nauell made; the *Greekes* call it *ὀμφαλός, ἀπὸ τοῦ ἰμπνέειν*, which signifieth to breathe, by reason of the Arteries in it by which the Infant in the Wombe breatheth or receiueth breath. *Aristotle* in the first Booke *Hist. Animal.* and thirteenth Chapter, calleth it *ῥίζα γαστρός*, the root of the Belly, because by these Vessels, as by the strings of the root, the Infant draweth nourishment from the Cake or Liuer of the Wombe, as it were out of the Earth. The *Latine* name *Vmbilicus*, is deriued *Ab Vmbone*, which signifieth the Bosse of a Buckler, which is represented in the middle of the Belly, yea in the very middle and center, (saith *Galen* 15. *De Vsu Partium* 4.) of the whole Body, if you stretch out your Armes and Legges, and draw a circle about them.

The names of the Nauell.

What it is.

The sixth Table, sheweth the Lower Belly, all the containing parts as well proper as common being remoued, and the Bowels lying in their naturall position, conuered with the Kall or Omentum, together with the Vmbilicall Vessels.

TAB. VI.



- A, A, B, B. The inner face of the *Peritonaeum* cut into foure parts, and so turned backward.
 B. The vpper B sheweth the implantation of the *Vmbilicall* Veine into the Liuer.
 C. The Nauell separated from the *Peritonaeum*.
 From D to the vpper B. The *Vmbilicall* Veine.
 E, E. The vpper part of the Stomacke blowne vp, neither conuered by the Liuer nor by the Kall.
 F, F. A part of the *Gibbons* side of the Liuer.
 G. Vessels disseminated thorow the *Peritonaeum*.
 * The Breast-Blade.
 H. The bottome of the Bladder of Urine.
 I. The connexion of the *Peritonaeum* to the bottome of the Bladder.
 K, K, K. The Kall conuering the Guts.
 M, N. Vessels and Sinneues embracing the bottome of the Stomacke.
 O. The meeting of the Vessels of both sides, so that M, N, and O, shew the same which *Aristotle* makes mention of in the fourth Booke of the parts of the Creatures, and the third Historie.
 P, P. Certaine branches of Vessels running along the bottome of the Stomacke.
 Q, Q, Q. Certaine branches of the Vessels distributed to the vpper Membrane of the *Omentum*, and compassed with Fat.
 a, a. The two *Vmbilicall* Arteries, going downe by the sides of the Bladder to a branch of the great Arterie.
 b. The Ligament of the Bladder which is shewed for the *Vrachus*.

The second Figure sheweth the *Vmbilicall* Veine.

- A. That part which isyneth to the Nauell.
 B. The other that is inserted into the Liuer.

The Nauell therefore is the stumpe of the *Vmbilicall* Vessels, by which the Infant was nourished

The vmbilical vessels,

nourished in the Wombe [Tab. 6. C.] therefore implanted into the middest of the Lower Belly, because it was requisite, that as well the Alimentarie as the Vitall Blood should first apply to the parts contained in this Belly. Now the *Vmbilicall* Vessels are these: one Veine, (in bruit Beasts there are two) two Arteries sometimes, (yet that rarely) but one diuided at the inside of the Nauell into two, and in Beasts the *Vrachus*.

The Vmbilicall veine.

The *Vmbilicall* Veine [Tab. 6. from D to B.] is the first of all the Veines, yea the *Principle of Perfection* of all the parts of the Body, in respect of their fleshy Substance, because it is the Vehicle or conueigher of Blood, as well for the matter whereof all the *Parenchymata* are formed as also of all the other parts; wherefore it is also the root of the Gate-Veine, and is formed together with the *Vmbilicall* Arteries immediately of the Seed before any of the Entrals. And this truth accordeth with the opinions of *Hippocrates* and *Galen*, and with right reason: For the Infant needeth both Blood and Spirits for the generation of his parts: Now because these must be conuayed by Vessels, it followeth necessarily that those Vessels should be generated before the parts themselves; and these are they. So we see the Seed of Corne or such like, when it is cast into the Earth, first of all, shooteth out of it selfe the beginning of the Stalke and of the Root together, that afterward the Stalke may be nourished by the Root: Semblably in the figuration of Mankind at the same instant that the substance of the Body beginneth to be moulded, the *Vmbilicall* Vessell is produced whereby the Creature might be nourished and augmented.

Hippocrates. Galen.

Comparison

The passage of the Vmbilicall veine.

This Veine [Tab. 6. from D to B.] passeth through the double Membranes of the Rim, and in the Infant hauing gotten through the place of the Nauill, becommeth sometimes two, sometimes presently after his egress is diuided, so that it seemeth to be double, and together with the Arteries is compassed with a Membrane called the *Gut-let*, and so runneth out into a great length; *Vesalius* saith of a foot and a halfe long, but oftentimes it is much longer, yea sometimes that length double & treble. The Veine is full of knots, by which some superstitious Midwives gather how many Children the Mother shall haue, but their true vse is to stay and entertaine the Blood, that it might receiue a more exquisite elaboration for the nourishment of the tender Infant. The Arteries because they are ordained to conuey the Spirits for the support of life are straight and even without any bossed knots at all.

The knots of the Veine.

The manner how they nourish and sustaine the Infant.

When these Vessels come vnto the *Secundine* or After-birth they disperse through it notable branches, and lesser toward his outward part, which attaining vnto the *Liuer or Cake of the wombe*, doe forme a Net-like complication, till at length they loose themselves into small hairy strings, by which as by the Tendrils of the Roots of Plants, the Mothers Blood both Alimentary and Vitall together with the Spirit is drawne out of the Mothers Veines and Arteries into these *Vmbilicall* Vessels. From whence the Veines conuey the Blood into the Gate-Veine, and from thence by the *Anastomoses* or *Inoculations* which are betwixt the roots of the Gate and the Hollow Veines, it passeth into the Trunke of the Hollow Veine and so nourisheth the whole Body of the Infant. The *Vmbilicall* Arteries by which the Infant hath transpiration doe transport the Vitall Blood vnto the *Aorta* or great Arterie, and from thence it passeth vnto the Heart to maintaine the natieue heat and life of the little Creature. But after the Infant is borne, the Midwife after she haue stroked downe the Blood to nourish the Babe, casteth it into a Knot close to the Belly, and then cutteth it off, and the stumpe that is left is the Nauill.

A direction for Midwives

The vse of these Vessels after the birth

The way of the Dropie water.

A cruell custome of the Egyptians.

The passage of the Vmbilicall Arteries.

And because the portions of these Vessels, which are left within the Body should not be altogether vnprofitable, they are turned into Ligaments. The Veine because it proceedeth out of the Fissure or Cleft [Tab. 6. B. and Tab. 4. Lib. 3. E.] which is in the hollow part of the Liuer, and thence attaineth betwixt the two Membranes of the Rim vnto the Nauill, becommeth the Ligament of the Liuer, which sometimes in Dropie Bodyes openeth (yea and even in our dissections we haue sometimes followed it with a Probe and found it open into the Liuer) and so auoydeth by the Nauill the Water which is gathered into the Liuer: but the chiefe vse of it is to tye downe the Liuer to the Nauill that it rise not vp and so stop the descent of the Midriffe in our inspiration. And this vse of it the *Egyptians* know full well, for they vse to stay at this day their Theeues, and they liue in great torment till the Hangman or Butcher cut the Nauill, and then they dye instantly, the Liuer gathering vp vnto the Midriffe and so stopping their breath.

The *Vmbilicall* Arteries [Tab. 6. A. A. Tab. 2. Lib. 3. k. l.] arise as most doe agree (though *Vesalius* be of another mind) from the *Iliacall* Arteries, or rather they are there implanted saith *Bauhine*, and running along by the sides of the Bladder [Tab. 2. k. l. Tab. 4. Lib. 3. a. a.] they

they passe vpward through the Membranes of the *Peritonæum* vnto the Nauill, and so become the laterall Ligaments of the Bladder.

Finally, the *Prachus* [Tab. 6. b. Tab. 2. Lib. 3. i.] or the *Vrinarie* vessell in Beasts, ariseth from the bottome of the Bladder [Tab. 6. H. Tab. 2. Lib. 3. g.] and ascendeth betwene the two Arteries through the duplication of the *Peritonæum*, and issuing out at the Nauill-stead is lengthned into two Guts as it were, and maketh that Coat of the Creature which is called *Alantois*, into which the Vrine of the Calfe is poured, which is there retained till it be calued.

The *Prachus*
in Beasts.

But in Man there ariseth from the bottome of the Bladder [Tab. 6. H. Tab. 2. Lib. 3. g.] a Ligament like to the *Prachus* [Tab. 6. b. Tab. 2. Lib. 3. i. i.] but it is not at all perforated. It passeth betwixt the *Vmbilicall* [Tab. 6. a. a.] Arteries, and is firmly knit vnto the Nauell [Tab. 6. c.] to which it fastneth the Bladder, and so holdeth it suspended, that it may not moue this way or that way, or be otherwise in danger of breaking, because (saith *Varolius*) whatsoever is separated from the Blood whilst the Infant is in the Mothers Wombe, is gathered together in the Bladder. Hence it is that new-borne Babes haue their Bladders distended & full of Vrine, which they auoid in great quantity before they take any sustenance. But after-ward as the Child groweth, this Ligament degenerateth into a verie small Filament or Twist with which the Bladder is tyed to the *Peritonæum*, and so sustained, that when the Bladder is distended, his necke might not be pressed. But of these Vessels

The use of it
after the birth

we shall haue occasion to intreat hereafter more in our Discourse concerning the

Conformation of the Infant. In the meane time this shall be sufficient. And

thus much of the Common Inuesting parts of the whole Body,

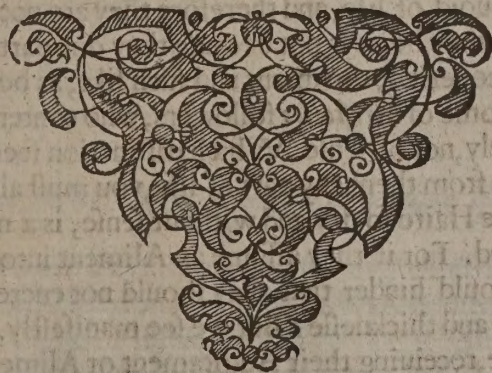
and of those that are particular to the Lower Belly. Now

it remaineth that we decide such Controuerfies

as are on foot concerning them, and so

passe on to the Nutritiue

Parts.





A Dilucidation or Exposition of the Controuersies concerning the Common Inuesting Parts of the Body, and those that properly belong to the Lower Belly.

QUEST. I.

How the Haires are nourished.



THE Controuersie concerning the Haires, how they are nourished or otherwise encreased, although it be a matter of no great necessity, yet it is verie difficult and full of Philosophicall subtiltie. That they doe encrease from short to long, is not doubted: So also it is past question that nutrition goeth before accretion. *Galen* in his first Booke *De Naturalibus Facultatibus*, and in the second *De Temperamentis* saith, that their generation is like the generation of Plants; and yet in his Booke *De Arte Medicsnali*, in the ninth Chapter, where he treateth of the differences of the Members, he saith, they haue onely a generation, no gouernment; that is to say, they are generated of recrements, but not nourished or gouerned by any Naturall facultie. And in his second Booke *De Temperamentis*, he thus expresseth their production: *But if the vapor be sootie, thicke and earthy, it remaineth impacted in the strait breathing Pores of the Skin, neither easily returning backward, nor easily euacuated; wherefore another vapor succeeding from within, striketh the former and thrusteth it outward, and so one vapor following another, they are in time complicated and conioyned, and make a roping Body like the Soot in a Chimney, but are not nourished at all by the assistance of any Facultie.*

Hence it appeareth, that they are onely Excrements, and their auction is but an improper accretion, vtterly deuoid of life, and therefore they are not to be reckoned among the parts of the Body; or if they be, it is not because they doe participate of life, but because they haue other vses of couering, ornament and such like, as before in their Historie is expressed. But there are some of *Aristotles* followers, who contend that they haue a life, but that of nourishment onely, not of sense. Which distinction seemeth to me to be verie friuolous. For if you take from them any part of life, you must also take away all life. Beside the very substance of the Haire so dry and without sense, is a manifest euidence that they cannot be truly nourished. For if they assume an Aliment into themselves, and alter it for their behoofe, what should hinder that they should not encrease according to all the dimensions, length, bredth and thicknesse? But we see manifestly, that they onely encrease in length and not otherwise, receiuing their Additament or Aliment, whether you will call it, onely at their Roots, not as other parts equally on euerie side. It will be objected that the Nails and the Teeth doe also receiue their Aliment after the same manner, and yet they are liuing parts. We answer, there is great difference. For the Nails and the Teeth haue all kinds of Vessels, Veines, Arteries and Nerues, inserted into their Roots, by which they receiue

Obiection.

Answer

receiue nourishment and sence, so haue not the Haires; and the reason why they are onely nourished at their Roots, is because Nature foresaw, that by continuall attrition & collision they would soone be worne away, vnlesse new matter were supplied vnto them at their Roots; and truly we willingly confesse, that the extreme parts of the Nails and Teeth which are farthest from their Roots doe not liue, neither are nourished properly, but onely are driuen forward by apposition and impulsion like as the Haires are. But it should seeme that the nature of the Haires and of the Nails is all one, because they both encrease in dead Carcases. Wherefore if the Nails be nourished, why should it be denied that the Haires also doe grow by nourishment? Hereto we answer, that true it is, as well the Nails as the Haires doe shoot out after death, but the manner is not alike; for the Haires, so and from the same causes grow in length after death, as they did before; the heat of corruption and putrifaction seruing as well, so long as the matter lasteth, to driue out the Excrement after death, as the naturall heat did while the Man was alieue; but the Nails doe not grow as they did in the life time, but onely become more prominent, the adiacent parts sinking from them, as being consumed by putrifaction. But it may further be vrged, that the nature of a putrified excrement when it is not ouer-ruled by the facultie, is not to breath outward to the Circumference, but to gather inward vnto the place where the most putrified matter is; and this is daily obserued euen in liuing bodies, that till the offending humor be brought into subiection vnto Nature, and receiue a kind of mitigation, it gathereth still to the Center; afterward, Nature hauing gotten the victorie, she driueth it as farre from her as is possible, euen to the Skin; as we see it falleth out in Criticall Sweats, in the Meazels, Small Pockes, and such like. Now if the putred Excrement haue no disposition to the Circumference in liuing Bodies when the secret passages of the Body are open, the Skin Porous, and the Faculties euery where at worke; how shall it passe that way after those passages and Pores are false, the habit forsaken of the Spirit, and the transpirable wayes locked vnder the Seale of Death? It seemeth therefore more reasonable to thinke that the matter of the Haires which is added after death, was a surplusage of the last concoction celebrated in the habit of the Body, and remaining in the extremities of the Vessels which determine in the Skin, which being in that place intercepted by the extinction of naturall heat, and hauing no Spirits to guid it backward; yet hauing before attained the perfection which the Facultie could impart vnto it, worketh it selfe a way through the Skin. But this knot will easily be vntied, if we consider that after death the Haires do not grow or encrease in any place of the Body, but onely in such, as wherein there were Haires standing in the time of life, to the Roots whereof, as I said before, the heat proceeding from putrifaction, is sufficient to driue, though not any humor, yet a vapor which may passe where the way was before thrilled and bored, but cannot where the Skin was not notably perforated. Again, there is a double limit, beyond which the excrecence of the Haire doth not proceed. For if either the confluence of the vapor to those Pores make a dampe, as in proesse of time it will, or the putrifaction of the vapor grow to a Venom, then the Haires cease to encrease, but fall not so soone in dead Carcasses as in liuing Men, because the Aire exiccateth and dryeth the Skin wherein the Roots are fastned; but in those that are alieue whose Skin is open, they fall not vpon a dampe, for there can be no such thing in a liuing Body, but vpon a confluence of a venemous vapor, as we see in the *French Disease* and the *Leprosie*. And so much of the Haires.

Obiection.
That Haires
and Nails are
both of one
nature.
Answer

Obiection.

Answer

QUEST. II.

Whether the Skin be the Organ or Instrument of Touching.

THE Philosophers and Physitians strue about the Instrument of Touching. *Aristotle* and *Alexander* call Flesh somtimes the *Medium* or meane through which we feele, sometimes the Organ or Instrument of feeling it selfe, but neuer the Skin. First, because the Skin is of it selfe insensible, and sensible onely by reason of the Flesh. For the Skin of the Head which is without Flesh, say they, is insensible. Secondly, because Flesh bared or exposed to the Aire, is more painfull then the Skin. Thirdly, because there is a more exquisite and discerning sence in the Flesh then in the Skin. For that Iewellers and Lapidaries doe more accurately discern the differences of roughnesse and smoothnesse,

The
Peripaterians
arguments.

An Axiome.

and such touchable qualities by the Tongue then by the Hand; and are able to distinguish betweene naturall and fictitious Precious Stones onely by the touch of the Tongue. Lastly, because it is a rule in Philosophy, that the sensible subiect being placed immediately vpon the Instrument of Sense is not sensible, but such sensible subiects placed immediately vpon the Skin are felt, therefore the Skin is not the Instrument of Touching.

Auicenna
Gen. 1. cap. 1.
De 3. q. 1. cap. 1.

The Physicians
ant opinion.
Their argu-
ments taken
from the tem-
per of the skin

2. De Animal.

Why laundy
eyes thinke all
things yellow.

The structure
of the skin.

The situation
of the skin.

Answers
to the
Peripatetians
arguments.
The first

The second

The third.

The fourth.

An interpre-
tation of
an Axiome.

The conclu-
sion.

Answer
to *Auicenna*.

To these may be added the authoritie of *Auicenna*, who writeth, that the Skin feeleth not equall Bodyes or Obiects; if it feeleth not equall Obiects, then it is not the proper Organ or Instrument of Touching; because euerie Instrument of Sense which the *Grecians* call *αἰσθητήριον*, apprehendeth both extreme and also middle Obiects; so the Eye seeth both the extreme colors which are blacke and white, and also all middle colors made of their mixture, whether they containe lesse or more of either of the extremes. On the other side, the Physicians affirme the Skin to be the Instrument of Touching, which will appeare to be the more probable and likely opinion whether we consider the Temper, the Structure, or the Scituation of the Skin. For the Temper, the Skin is the most temperate of all the parts and in the very midst of the extremes, and is as it were the Canon or rule of them all; and therefore can giue a more perfect iudgement of the tactile qualities.

Aristotle hath determined that euerie *αἰσθητήριον* or Instrument of Sense should be *ἀσθητόν*, that is, deuoid of all qualities whereby that sense is affected. So the Christaline humour which receiueth the Images and specres of visible things, is deuoid of all colours; the yellow Eyes of those that are full of the Jaundise imagine all things to be yellow. If the Tongue be moistned with choller, all things though sweet haue a bitter range: In the Nose there is no particular and peculiar sent; no sound naturally residing in the Eare: Right so the Skin which hath no excessse of qualities is to be esteemed the Organ or Instrument of Touching.

If we consider the Structure of the Skin, there are moe Nerves disseminated into it then into the Flesh, but the Nerves are the common conueyers of all sensible Spirits, which they continually minister vnto the Senses, whereby their operations are perpetuated. And for the scituation of the Skin, it is much more commodious then that of the Flesh, because it is neerer to the occurration or confluence of outward obiects; because it is the limit and border as it were of all the parts. The Skin therefore is rather the Instrument or Organ of Touching then the Flesh. As for the fore-named obiections of the *Peripatetiks* they are easily answered: For first, we deny that the Skin feeleth by helpe of the Flesh. I instance thus: Cut a Nerue which endeth into the Flesh, presently the motion will cease, but the sense of the Skin will remaine; but if a Nerue be cut which passeth vnto the Skin, presently the sense it selfe will be abolished. Againe, true it is that Flesh when it is bared is more sensible and painfull then the Skin; but the reason of that is, because it is looser and lesse accustomed to outward iniuries of the Aire or ought else; whereas the Skin is so accustomed to the Aire, that it feeleth it not. So the Teeth being vsually opposed to the Aire, are not affected therewith; but other Bones if they be bared doe presently putrifie. To proceed, the Tongue hath a more exquisite apprehension of the coldnesse and inequality of Precious Stones; but that apprehension is not from his Flesh but from his Membrane; now Membranes are also Instruments of Sense. And whereas it is said that the sensible subiect or obiect being placed immediately vpon the Instrument of Sense, is not sensible; that I say is vtterly false, for by that reason there should be no Organ of Touching saue onely a Bone, a Gristle, or a *Vinculum* or Tye.

That Axiome of *Aristotle* stands need to be interpreted: Of the Senses some are absolutely and simply necessarie to our life, as Touching and Tasting; some are *ad bene esse*, that is, for the better being of the Creature, but not simply necessarie to his being, as Sight, Hearing, and Smelling. The *Medium* or meane of these last is externall & separated from the Instrument; the *Medium* of the first is internall, and so ioyned with the Instrument that it cannot be separated. In the first this Axiome is true; for if any colour be layd vpon our Eye, we see indeed, but very depraudedly, being not able without an outward meane to distinguish, so likewise it is in Hearing and Smelling: but in Tasting and Touching because the *Medium* is internall, the obiect may be, yea is best distinguished when it toucheth the Instrument. We therefore conclude, that the Skin is the Organ or Instrument of Touching, and the Cuticle or Scarfe-Skin is his *Medium* or meane.

Whereas *Auicenna* saith, that the Skin doth not feele equall or temperate things, he meaneth that it is not violated or ill affected by them when it feeleth them, not that it feeleth them

them not at all: for that common experience would condemne. Lastly, you will say that the Skin feeleth by the helpe of Nerues; the Nerues therefore are the Instruments of feeling, not the Skin. I answer, the Flesh of the Muscles are moued by the Nerues, yet is not the Nerue the immediate Organ of voluntarie motion, but the Muscle. In like manner the Nerue giueth sense vnto the Skin, because it bringeth downe vnto it the Animall facultie and Spirit, yet nathe-more is it the immediate Instrument of Sense. But *Galen* saith, that the Stomacke is the Organ of Touching, because his sense is most exquisite: Surely the Mouth of the Stomacke is wondrous sensible, because of the notable Nerues it receiueth from the sixth coniugation, and by reason of the hunger and thirst of which it onely is apprehensue: we acknowledge it the Instrument or Organ of a peculiar & particular Touch, as also the parts of Generation haue their peculiar Touch whereof they are Instruments; but onely the Skin is the Organ of externall touching, and sole Iudge of all tactile qualities.

Another
argument
answered.

Answer to
Galen's
authoritie.

Peculiar
touches in
mens bodies.

QUEST. III.

Of the Temper of the Skin.



Alen is of opinion that the Skin is absolutely temperate, because it is of a middle nature betweene bloody and vnbloody, whence it is called a Neruous Flesh and a Flethy Nerue; so in another place, if the Flesh be adstringed and dryed, it becommeth like the Skin; for the Skin is dryer and thighter then the Flesh.

That the Skin
is temperate.

Hippocrates also expresseth so much, where he saith, *The outward Skin which is continuall with it selfe and with the bloody Nerue, because it is exposed to the Aire, sometimes colder, sometimes warmer, is often affected by both, and needs now and then the helpe of the one to temper the other.*

Hippocrates.
That it is not.

On the contrarie it may be proued by the authorities of *Galen* & *Auicenn* that it is not Temperate. *Galen* saith, that the Skin is nourished with Phlegmaticke Blood; it is therefore of the Temper of Phlegme, for the nourishment of any part is the same with that whereof it is compounded. *Auicenn* saith, that the Flesh commeth neerer to exact equalitie of Temper then any other part. The Flesh therefore and not the Skin is Temperate. Moreouer, that cannot be temperate which is the weakest of all parts: Now the Skin receiueth the superfluities of all the inward parts, and is therefore called the Vniuersall Emunctorie. But all these Knots may easily be cleft with a soft Wedge. The Skin is nourished with Phlegmaticke Blood, that is, not fully boyled and laboured, when we know it is hot not cold. *Auicenn* saith not, that Flesh is most temperate, but that it commeth neereft to that which is temperate; so the whole Body of Man is said to be temperate, although it be hot and moyft.

Galen:

Answer
to the argu-
ments which
proue it to be
temperate.

The weakenesse of the Skin proceedeth not from the Temper, for it is not weake of it selfe, or of it owne nature, but by euent, by reason of the scituation and the Vessels. For the greater Vessels because they are neerer to the Fountaine are the stronger, and the expelling vertue of the inner-parts more powerfull: Whence it is, that the inward parts expell their superfluities into the outward, and the greater vessels into the smaller vessels of the habit; so that the Skin becommeth weaker, because the expelling faculty is withinward & stronger, and layeth all the burden vpon the Skin. And so much for satisfaction of the Aduersaries.

Why the Skin
is weake and
becomes an
Emunctorie.

There is another scruple arising out of this Doctrine of the Temper of the Skin; and that is, whether a Physitian by the Skin may iudge what is the Temper of the whole Body. *Aristotle* gathereth from this Instrument of Touching, the vigour of the mind it selfe, because where the Touch is fine, there the Sense is lesse polluted, and the Phantasmes arising therefrom more subtle; and so the operation of the Soule higher and more abstruse. *Galen* resolue the doubt, where he saith: They are in an error who doe determine alwaies of the Temper of the whole Body by the Skin; for though the Skin be hard, yet is not the Creature necessarily dry; neither if it be soft and without Haire is the whole Creature moyft; yet if the whole Body be in equall Temper, then it is reasonable that all the parts should be proportionably correspondent to the Temper of the Skin, but if the Body be vnequally tempered as often-times it is, from the Nature, by accident, or by disease, then is it not reasonable to iudge of the Body by the Skin. For we see that in Oysters the Flesh is very moyft, yet is their Skin, which is their Skell, beyond measure dry.

Whether by
the Skin the
temper of the
whole body
may be
knowne.
Aristotle.

Galen's
resolution
of the
question.

QUEST. IIII.

Of the Originall and Generation of the Skin.

The common
opinion.

Other opini-
ons.

The difference
betweene a
scar and the
true skin.
Another opi-
nion.
But proued
false.

The determi-
nation.

An argument
that the skin
is made of
seede, and
blood.

Here are many opinions about the generation of the Skin. The common opinion is, that it ariseth from the dilated ends of the Veines, Arteries and Sinews, because it euery-where feeleth, liueth and is nourished: Now life is communicated by the Arteries, nourishment by the Veines, and sense by the Nerues or Sinews. For my owne part I doe not deny but that many Vessels are carried vnto and doe determine in the Skin from the Axillarie, Iugular & Crurall Veines, many small Surcles, and as many Arteries bearing them company: Interlaced also it is with manifold Nerues, but yet I am not resolu'd that the Skin is wouen together of their Threds. *Galen* thought the Skin was the first part of the Infant that was formed, the truth of which assertion we shall diseusse in another place. Some thinke the Skin is made of the superficies of Flesh dried, because in wounds the Flesh dried degenerateth into a Cicatrice or scar, which is very like the nature of the Skin; this may be confirmed by the authorities of *Aristotle* and *Galen*. *Aristotle* auoucheth that as the Flesh groweth old, so it turneth into Skin. *Galen*, that the Skin is produced out of the Flesh which is vnder it. But because between the Flesh and the Skin there are many Bodies interposed, to wit, the Fat and the Flethy Membrane, which is truly Neruous, vnlesse it be about the Necke and the Face; I cannot see how the Skin should grow out of the Flesh. And that Skin or Scar rather which resulteth vpon the wounds, when the Flesh is softned and dried by *Epulotical* Medicines as they call them; is not a true Skin but illegitimate, ingendred of a substance of another kind; for it is harder then the true Skin & more thight, and therefore neuer hath any Haire growing vpon it; and in tanning it will fall away, whence comes the holes in Sheep-Skins when they are made into Parchment. Some thinke it is compounded of Flesh and Sinews mingled together, because in many places of *Galen* the Skin is called a Bloody Nerue; but this is proued to be false by this one argument, because where there is most store of Nerues, there the Skin is not the harder for them; as in the Palme of the Hand there are more Nerues then in the Crowne of the Head, & yet the Skin in the Crowne is much harder then that of the Palme. I thinke, and for this time determine, that the Skin is ingendred together with the other parts, to wit, of Seed and Blood mixed together; and may therefore be called a Flethy Nerue, or a Neruous Flesh, because it hath a middle nature betweene Flesh and a Sinew: For it is not vtterly without Blood as a Nerue, nor so abounding with Blood as Flesh. That there is Blood in it appeareth euidently if it be neuer so little wounded: That it is of Seed, this one argument may serue for all, that when it is perished it can neuer be restored; for it is impossible to heale a wound where any part of the Skin is taken away without a Scar or Cicatrice more or lesse.

QUEST. V.

Whether the Skin performe any common and officiall Action.

The common
opinion.

*Hip. lib. de natu-
ra. of sinum.*

The common
action of the
skin is animal.

How sensation
is made.

MAny Physitians haue the same opinion of the vse and action of the Skin which they haue of the vse and action of Bones. The Bones haue a common or officiall vse, so saith *Hippocrates*, they giue the Body stabilitie, vprightnesse and figure, but they performe no common or officiall action. I account that a common action which is seruiceable either to more parts or to the whole Creature. In like manner, the Skin hath indeed a common vse, because it couereth the whole Body, cherisheth it and tyeth it together, but it is not thought to performe any officiall or common action. *Galen* speaketh very plainly, *The Skin* (saith he) *concocteth not, as the Stomacke; it distributeth not, as the Guts and the Veines; it breedeth not Blood, as the Liuer; it frameth not any pulsation, as the Heart and the Arteries; it causeth not respiration, as the Lungs and the Chest; it moueth not with voluntarie motion, as the Muscles.* Notwithstanding all this, one common action may be attributed vnto it, to wit, an Animall action. For although all sensation is passion, because to be sensatiue is to suffer, yet there is no sensation without an action. The better learned Philosophers in all sensation doe acknowledge a double motion, one Materiall, another Formall: The former motion

motion is in the reception of the Species (for we must craue libertie to vse our Schoole rearmes) the latter in an action; the first is in the Instrument by reason of the matter, the latter by reason of the power is in the Soule; the first is not the effectuating cause of sensation, but a disposition thereto; the latter is essentially sensation it selfe. Whereas therefore the Skin is apprehensive of those qualities which strike or moue the tactiue sense, and is thereupon esteemed the Iudge and discernet of outward touching, it performeth vnto the whole Creature not onely a common vse, but also a common or officiall action. Beside it hath another priuate action, to wit, Nutrition, to which as Hand-maids doe serue the Drawing, Retaining, Concocting and Expelling Faculties, and more then these hath no part in the Body of Man which serueth for the behoofe of the whole. We conclude therefore, that the Skin beside his common vse and priuate action performeth to the Body a common and officiall action, to wit, Sensation.

The priuate
action of
the Skin.

QUEST. VI.

Whether it be heat or cold, whereby Fat is congealed.

THE diuers, yea contrarie gusts of opinions amongst ancient Physitians about the generation of Fat, hath rayseed such a tempest in our Art, that the waues are not to this day settled. There needeth therefore some *Aolus, mulcere hos fluctus* to appease these waues, to call in the winds, or to abate them into a calme, which we will at this time intend to doe in want of better helpe as well as we may. And because we would not be accumbred with the varietie of names which are vsually giuen to this substance, you shall vnderstand, that *Pinguedo, Adeps, Auxungia* and *Serum*, are promiscuously vsed by Physitians, albeit *Aristotle* and *Galen* haue taken great paines to distinguish them euerie one from another. To which places, we referre those who desire herein satisfaction. For we will onely paine our selues about the temper and generation of Fat at this time.

The names
of Fat.

2. *De Part. Animal.*
4. *et 11. De Simpt. Medic. Facultat.*

Galen is of opinion, that Fat is congealed by cold, and that he expressly declareth together with the manner of it in this manner. When the airy & more oily part of the Blood sweateth through the thin coats of the Veines in manner of a dew, and lighteth vpon the colder parts such as are Membranes, it is then by the power of the cold condensed. And hence it is, that Women are for the most part fatter then Men, because they are colder; and the same reason is of all other Creatures growing fatter in the Winter time, as doe also those that haue smaller Vessels; now we know, that the smalnesse or narrownesse of the Vessels, is caused by the coldnesse of the Temper. And if at any time those Creatures which haue large Vessels doe yet grow fat, it is not from their naturall, but from an aduentitious temper acquired by accident (to wit) by dyet and order of life. Moreouer, that Fat is congealed by cold, hence it is euident, because by heat it is presently molten and liquefied. The lower Belly because it is Membranous & farre remoued from the Fountaine of Heat, is therefore couered ouer with a leafe of Fat, which somtimes is of great weight; but the parts vnder the Brest haue lesse Fat about them. And this is the Philosophy of *Galen*, and almost all the *Greeke* and *Arabian* Physitians. Those that hold the contrarie, doe thus demonstrate the matter of Fat to be hot, the worker of it Heat, and the effects of it hot. For the matter, *Galen* himselfe acknowledgeth it to be made of the airy and oily part of the Blood, as also is *Choler* and *Seed*; and therefore those Creatures that are fat grow barren, and if we would fatten any thing, we first lib or geld it. And *Aristotle* saith, that that which is fat, is neither earthy nor watry, but airy, and therefore it floteth alwayes aboue. Now Aire we know is hot and moyst. That the efficient or working cause is hot, *Aristotle* first of all Men proued, where he saith, That Fat is made by concoction or boyling, but it is onely Heat which concocteth or boyleth any thing. And in his *Problemes* he giueth this reason, why that which is fat is not of ill sauer, Because (saith he) it is not crude or raw, but concocted. This opinion of the Philosopher doth the learned *Veiga* follow and *Argenterius*, as also *Laurentius Ioubert*, who set forth an elegant and subtile Paradoxe concerning the nature of Fat. The weight of the principall reasons for this opinion, we will as briefly as we can set before you. All concretion is made by that which is actually cold, as is seene in Ice, Oyle, Hony and such like, which by the outward cold Aire is congealed: but there is no such actuall cold in a liuing Body; the Bones are very hot if they be touched, and all the Mem-

How Fat is
curdled.
Galen's opinion
on by cold.

Why women
are fatter
then men.

Arguments
to proue that
it is curdled
by heat.

3. *De Hist. An.*
2. *De Part. An.*

The cold can-
not congeale
the Fat.

Melancholy
Men seldome
fat.

The effects of
Fat are hot.

*Pinguis sedem
et metropolim
esse calidum.*

The determi-
nation.

What kind of
cold curdleth
Fat.

Exemplifi-
cations.

Lesse heat is
taken for cold

Why Melan-
choly Men
sweat much.

It is a fiery
heat that we
live by.

Meanes are
contrarie to
their Extremes

branes are actually hot, for the membranous Stomacke boyles the *Chylus*, the membranous Bladder burneth the Flegme euen into a Stone. *Auicenn* saith, that the Membranes are hotter then the Braine; now the Braine is hotter then the most foultry hot Aire that is in the heat of Summer: but the Summer heat melteth and congealeth not; the coldnesse therefore of the Membranes cannot congeale the Fat. Againe, the Heart which is the hottest of all the inward parts, and in perpetuall motion, is yet compassed about the *Basis* with abundant Fat. About the Membranes of the Braine, which are watred as it were with abundance of Blood, and wouen with many thousand Vessels, neuer any Fat adhereth: nor vnto the coats of the Bones. Old men and Melancholy persons, whose temper is cold, haue yet little Fat. The Kidneyes which are very hot, and bake, yea burne Flegme into Stones, haue yet about them abundance of Fat. Beside, the Fat is a liuing part of the Body, because it hath a certaine and definite forme or figure, and is whitened by the power of the Membrane which altereth it; now who euer durst say, that a liuing part of Mans Body was made by a ctuall cold? We may also adde the authoritie of *Galen* fauouring their opinion, where he saith, That in cold and dry Bodyes the Fat is larded amidst the Flesh, not about the membranous Coats; but euerie one will confesse that Flesh is hot. Finally, the effects doe teach vs that Fat is hot. For *Galen* reckoneth it among concocting Simples; and the fatty Kall (saith he in his Booke of the vse of Parts) by his heat furthereth the concoction of the Stomacke; beside, it easily taketh fire. Wherefore they referre the cause of the concretion or congealing with *Aristotle*, to the fastnesse and thightnesse of the Membranes. For say they, the airy and fat part of the Blood, passeth easily thorough the rare and spongy Flesh: but when it commeth to the Membranes, there it is stayed and congealed by heat, and becommeth white through the operation of the Spermatieall part to which it adhereth, to wit, the Membrane. Adde hereto the authoritie of *Hippocrates*, who saith, *That heat is the seat and residence of Fat.*

Thus you see the Battell pitcht on either side, and contrarie Ensignes and Armes in the Field. Both parts cannot be maintained. It is more safe to side with the old Legions led by *Galen*, and followed by the Ancients, then with new and vp-start Nouices: wherefore, we will determine thus; I wish it may be with approbation of the best.

The matter of Fat is airy and oily, the efficient cause a congealing cold, yet not absolute and actuall (for there is no such cold in any liuing Creature) but lesse hot, which Philosophers take for cold, so that the Fat is congealed not by parts that are absolutely cold, but by parts that are lesse hot then others, such as are Membranes. But this may better be exemplified, then taught by precept. Lead, as soone as it is taken off the Fire, although it be yet fiery hot, caketh together: this concretion is either by vertue of heat or cold; not by a fiery heat, for that melted it before; not by actuall cold, for if you touch it thus caked, it will burne; therefore by a remisse heat, which to it is in stead of cold. For there is a certaine degree of heat, which will not suffer Lead to cake, nor Fat to curdle. This degree is onely in the Fleahy parts; whence it is that Fat neuer growes about them. But Membranous parts, because they haue not the same degree of heat, doe curdle the oily part of the Blood into Fat. When a Vessell of boyling Water is couered, though the couer be hot, yet the vapor of the Water turneth into a steame vpon it, and will stand in drops, yea will run from it in Water, as we see in Stils, though the Head be so hot that a Man cannot touch it. What then is the reason? Because in the couer there is a lesse heat then in the boyling Water. For it is heated onely by a vapor, the Water immediately by the Fire. The lesse heat therefore of the Couer or Head, is in stead of cold to the boyling Water.

In like manner, in Melancholy Men their hot and boyling Entrals raise vapors, which when they come to the Skin which is lesse hot then the Entrals, are gathered and thickned into Sweat. So the breathing vapors of all the lower parts being raised into a hot Braine which yet is lesse hot then the lower parts, are turned into Water, and fall downe in Rheumes, Gowts, and such like. After this manner therefore we say that Fat curdles by cold, that is, by a lesser heat then will melt it; so we say the Braine is cold, that is, lesse hot, although it be hotter (as we haue said) then the Aire can be in the heat of Summer. That Summer Aire or hot Gleames we call hot, and so they are; yet are they cold in respect of Fire, yea cold in respect of the heat of a liuing Creature; the Heart by them being refrigerated: For our life is proportionable to Fire; and it is a true rule in Metaphysicks (that is in Logicke) that *Meanes are contrarie to their Extremes*, else should not Liberalitie which is a Vertue, be contrarie to Couetousnesse & Prodigalitie, which are the Extremes and Vices.

These

These things being thus first determined, we will now answer the Arguments vrged against vs. First, we deny that all concretion or coagulation is done by actuall cold; for as it is said, Lead yet fiery hot will congeale; and whereas Fat groweth to the Heart, which is the hottest of all the parts, we answer, that herein is a great document of the wonderfull and prouident wisdome of Nature, who hath thus prouided least in perpetuall motion the Heart should gather so great a heat as should waste and consume it; for which cause also saith *Hippocrates*, it lyeth in water much like Vrine, that it might euer be fresh, and as it were flourishing.

Answer to the former arguments.

The wonderfull prouidence of Nature.

Chrysippus that notable *Stoicke* in his Booke of *Prouidence*, saith that the finall cause ouercommeth both the efficient and matter in naturall things; and *Aristotle* against *Democritus* saith, that in the workes of Nature the end is the first and chiefe cause, for it moueth the other causes, it selfe being immouable. I know that our aduersaries will object, that Nature induoureth nothing against her owne Lawes, she should therefore haue made the Heart temperate. But let me retort their owne weapon against them, Nature should haue made the Heart originally temperate, that there might haue been no need of breathing cold aire; how absurd this opposition against the wisdome of Nature is, no Man but seeth. For the Heart was necessarily to be created very hot, because in it is the Hearth and Fire whereby the naturall heat of all the parts is preserued and refreshed. If they thinke not the Fat of the Heart necessarie, let them remember that it groweth not in the Ventracles, nor in the Flesh of the Heart, but onely vpon the Membranes of the Vessels, which are parts lesse hot then any of the other. Some there are which adde further that this Fat is a part of the Heart, because it keepeth alwayes the same figure and circumscription, and is not melted by Fire, but rather torrifieth.

The finall cause is the first and chiefe in workes of Nature.

For the Membranes of the Braine, we say they haue no Fat, because there was no vse of it; yea it would haue hindred the breathing out of the smoaky vapors by his clamminesse. For the Braine like a Cupping-glasse draweth continually and sucketh vp the expirations of the inferiour parts, to which if the Combe-like Sutures of the Skull did not gape and giue way, the Braine would be made as it were drunke with their abundant moystures. Beside, Fat would haue hindred the motion of the Braine, for it moueth perpetually as the Pulse doth, as we shall shew in due place; wherefore in the Braine there wanteth the finall cause of Fat. The materiall cause is also wanting, because there is required a great abundance of Blood for the nourishment of the Braine, and for the generation of Animall Spirits; it behoued not therefore that it should be conuerted into Fat. Old men and those that are melancholy are seldome fat, because the materiall cause of it is wanting, for they are too dry. The Fat of the Kidneyes compasseth not the Flesh, but their Membranes onely. *Aristotle* saith, that both Kidneyes are fat, but the right lesse then the left, because it is the hotter. And whether the Fat be a living part, we shall dispute in our next exercise. Finally, whereas *Galen* saith, that in cold and dry Bodyes the Fat is larded through the Flesh, not through the Coats or Membranes. We answer, that by Flesh in that place he vnderstandeth the Muscles which are couered with their proper Coats, to which Coats the Fat groweth, because they abound with Blood and Veines; but in those Coats that are most distant, whereof he there speaketh, because of their drynesse there wanteth matter of Fat; for you may remember we taught you before, that Fat is not ingendred but onely where there is an ouerplus of Blood which sweateth through the spongy Flesh after it is satisfied. Now in cold and dry Bodyes, such as *Galen* there speaketh of, there is no such abundance of Blood that there should be any ouerplus. The effects of Fat which they mention, conclude nothing; it is true that Fat is a concocting Medicine, and that the Fat of the Kall relieueth the heat of the Stomacke, but not primarily and of it selfe, but by euent, because the thicknesse and visciditie or clamminesse of it hindreth the euaporation of the heat, which by that meanes is doubled; besides, it stoppeth vp the Pores, that the piercing cold cannot reach vnto it. Wherefore it heateth the Stomack, as Cloathes heat the Body, not by adding heat, but by keeping the naturall heat in, and externall cold out. That it easily flameth, proceedeth from his oily and airy matter, so Camphire burneth in the Fire, which yet all Men take to be cold.

Why there is no Fat in or about the Braine.

Why Melancholy men are leane.

Galen expounded.

How Fat heateth the Stomacke.

Why Fat flames.

Moreouer, the effects doe not proue the efficient cause of Fat to be heat; for Oyle which becomes thicke and congealed in Winter, presently taketh flame, and yet no Man will deny but that it is congealed by the externall cold of the Aire. We therefore conclude that Fat is curdled by cold, that is, by a lower or more remisse degree of heat, & that it

The conclusion.

it groweth or adheareth onely to Membranes, because their heate is weaker, as hauing no continuitie with the Heart, and therefore deprivied of that plentiful influence of heat there-from, which the other parts of the Body doe enioy which haue a more notable continuitie with it.

QUEST. VII.

Whether Fat be a living and animated part of the Body.

Authorities
to proue the
Fat to be a
living part.



HEY who imagine that Fat is curdled or congealed by heat, beare themselves much vpon this Argument, that no true part of the Body is condensed by cold: Now say they, Fat is a part and a living part of the living Creature: This point we call into question. It may, I confesse, be made probable both by authorities and by arguments. *Galen* in his Commentaries, reckons it among the Similar parts; and in another place he saith, it euerywhere performeth the same office as the Veines, Arteries and Sinewes; if it performe any office to the Body, then certainly it is a living part. Againe, in another place where he reckoneth vp foure differences of parts, he reckoneth the Fat among those that are gouerned by themselves. In his Booke of the *Differencies of Diseases*, he saith the number of the parts is abated, if the Arteries, the Veines, the Nerves, the Flesh and the Fat, be not accounted among them. In his Booke of the *Vnequall Tempers*, the parts of the Fingers and Toes are these; the Bones, the Cartilages, the Ligaments, the Arteries, the Veines, the Flesh, the Skin, the Fat. And the Authorities may be seconded by Arguments.

In Lib. Hipp.
De Nat. Hom.

Lib. 6. De Pla.
Cap. 8.
Reasons.

1

2

3

Answered:
A two-fold
part.

Arguments
that it is no
animated part

Galen

Answer
to the au-
thoritie.

Why Haire
and Fat grow
not in old age

How the Fat
becomes
whitish

For the vntying of this Knot, we must know that there is a two-fold acceptance of a part, one more large, the other more strict. In the large account, whatsoever addeth any thing to the accomplishment of the whole, may be called a part of the whole which it helpeth to accomplish. In which respect the Fat deserueth the name of a part, as also the Haires, the Naitles, the Marrow, the Blood, yea and Milke it selfe. But in the more presse and strict signification, the Fat cannot be called a part, because it neither partaketh of a common life, as we say, neither hath it any proper figure or circumscription. And moreouer as *Galen* witnesseth, in Famine and want of Nourishment it may be conuerted into Nourishment: now one part cannot nourish another, but all parts that inioy common life, haue also one common nourishment, either immediate or mediate. Adde to this, that it is neither a Spermaticall nor Fleishy part; not Spermaticall, because it appeareth not in the first delineation of the parts; not Fleishy, because all fleshy or bloody parts are red: and therefore it is no living part partaking of the living Soule.

Concerning the places alleaged out of *Galen*, where he calleth it a Similar part, he vseth the name of part in the larger signification; where he saith, it is the author of a function, or performeth an office: by office or function he meaneth a vse. For *Galen* often confoundeth an action and a vse, although there is great difference betweene them; for the Haires haue a vse, yet they performe no office or action. Whereas they obiekt that it is increased; we grant it, but how? By apposition onely, as the Haires also grow and increase, not by assimilation of Aliment as other parts doe: and therefore it onely increaseth so long as it hath matter, when the matter ceaseth, as in old age it doth, then it ceaseth to be generated.

The whitenesse of the Fat say some, is acquired not by the forming facultie, but by cold, as all Phlegme is white, whose efficient cause is cold. I thinke the whitenesse comes by a light alteration which the Blood hath from the Membranous parts. For when as any notable quantitie of Blood falleth vpon the Membranes, it receiueth indeed a light rudiment of alteration from the power or facultie of the Membrane; but because the quantitie is greater then can be assimilated, and yet it is impacted about the Membranes, it is condensed by their weake heat; but is not changed into the nature of the part where it is condensed: so that if it be a part, it is but an imperfect part; and this *Aristotle* perspicuously discerned

discerned in his Booke of Parts, where he saith, that there is this difference betweene Flesh and Fat: That in the generation of Flesh the Blood is so thoroughly laboured and mitigated that it is turned into a part partaking of Sense: but in the generation of the Fat, the Blood is indeed changed into a part, but that part is not capable of Sense.

The last Argument may thus be answered: The Kernels which are found among the Fat, are not generated by the Fat, but haue a delineation, though not conspicuous in the first forming of the parts, and afterward the Fat incompasseth them or groweth about them: or it may be said, that those Kernels are generated by the heat of the adiacent parts, not of the Fat. And these are the Questions which are controuerted concerning the Skin and the Fat.

QUEST. VIII.

Of the Membranes, vse and production of the Peritonæum.



Concerning the Rim of the Belly, there is some difference betweene the Ancients and the later Writers, yea and amongst the *Neotericks* themselves. The Ancients thought it was a single and simple Membrane, because in Dissection it appeareth to be very fine and thin like a Cobweb. *Columbus* saith, that it is single onely from the Brest-blade to the Nauill, and double from thence to the Share, and that because of the Vmbilicall Vessels which are carryed through the Duplication. *Laurentius* saith, he hath alwayes obserued it double euery-where; aboue and below, before and behind, on the right-hand and on the left; and auoucheth that all Membranes of the Body, euen the *Pia Mater* or thin Membrane of the Brane, are alwaies double. For, saith he, as below betweene the duplication of the *Peritonæum*, there arise two Arteries and the *Ourachos* vnto the Nauill, so from the Nauill to the Liuer passeth the Vmbilicall Veine betweene the same duplication aboue; and therefore wondreth at *Columbus*, who was so occulate an Anatomist, and yet did not obserue so much. *Galen* obserued a third vse of the *Peritonæum*, which is to presse the Guts, and to driue downe the Excrements of the Belly. This vse *Vesalius* derideth: for how can it haue this vse (saith he) when it hath no voluntarie motion of his owne, whereby it can contract and distend it selfe? By the same reason, the *Pleura* should helpe the Midriffe in the contraction of the Chest. We answer for *Galen*, that he doth not intend that the *Peritonæum* doth this by his owne proper motion, or by it selfe, but onely by accident and euent. As when the Muscles of the *Abdomen* and the Midriffe like Hands ioyned aboue, and open below, doe presse and driue downe-ward that which is straightned in the midst betweene them, then the *Peritonæum* which holdeth these two in their proper positions, maketh the pressure more forcible.

Vesalius beside denies, that there are many productions of the *Peritonæum* in Women, because their Testicles doe not hang downe, but are trussed vp to the sides of the Wombe; but he obserued not that these productions reach in Women to the Leske, and become the *Cremasteres* of the Wombe, and that there are the same holes or passages in the Tendons of their oblique descendend Muscles which are in Men; whence it commeth to passe, that Women are often troubled with the *Bonbonocle*.

Columbus.

Laurentius.

All the Membranes of the body are double.

Galen's 3. vse of the *Peritonæum* derided by *Vesalius*.

Galen expounded.

Why women are so often troubled with *Bonbonocle*.

QUEST. IX.

Of a new kind of Compunction of Dropsie Bodyes through the Nauill.

It shall not be amisse in this place, to annex a kind of Compunction of the Nauill, by which the Water is safely let out in Dropsie Bodyes. The ancient Physitians called all Apertions of Dropsie Bodies *παράκρυσις*. In the administration of which *Paracentesis*, there arise foure Questions. Whether it be feasible, when, where and how it is to be performed. That it may be done safely, remaineth vnder the Testimony of many Witnesses, all beyond exception; and beside, it may by reason be demonstrated. *Hippocrates* first of all other, prescribes it both in his Aphorismes, and also in diuers other places. *Galen* in the 14 of his Method, *Paulus* of *Aegina*, *Albucaſis*, and in a word, almost all Physitians.

Paracentesis.

That it is feasible.

Hippocrates *Galen.*

Besides

Besides Authorities, Reason also addeth her suffrage to this attempt. For when these restagning or gathering Waters, can neither by outward nor inward Medicines be euacuated, why should we not proceed to Section in these, as well as in other watery and flegmaticke Tumors? Especially seeing the parts wherein the Section is to be made, are all ignoble and base.

The time for
this worke.

The time fit for this Apertion, *Hippocrates* elegantly describeth, where he saith, *Dropſie Bodyes muſt preſently be cut, and thoſe that are Empui. preſently burnt.* This preſently, *Hippocrates* himſelfe interpreteth to be, *out of hand, or in the beginning of the diſeaſe.* *Galen* ſaith, it muſt be *before the inward parts are corrupted*; for the Water is in vaine let out, if the Entrals be vitiated, eſpecially any thing notably; becauſe it will inſtantly and continually gather againe. So then it is a foule error in a deplorate or deſperate Dropſie, to vndertake this kind of Cure, becauſe (as *Ceſus* very well ſaith) it is a kind of impietie in Art raſhly or inconfiderately to prophane ſuch remedies, as being rightly vſed may be of great auaille.

The place.

The third Queſtion is concerning the place for this Apertion. *Paulus* and all Phyſitians after him, euen to theſe times, adminiſter this Section a little below the Nauill towards the ſides, becauſe of the *Tendons* or *Chordes* of the Muſcles: and that on the ſide that is oppoſite to the part affected; as if the Liuer be affected on the left ſide, if the Spleene on the right. That kind of Section is not to be diſcommended, yet *Laurentius* thinketh, it may be more commodiouſly done through the very Nauill, and for his oppinion bringeth very rare obſeruations, and ſtrong reaſons.

Aponcuroſis.

Laurentius his
new conceit
eſtabliſhed.

By Hiſtorics

Antonius Benneuenius recordeth, how a certaine Dropſie Patient being giuen ouer by the Phyſitians, by a raſh and caſuall aduenture recovered his health. For, when he was exceedingly dry (as is vſuall in that diſeaſe) and in deſpaire of recouerie, he poured in an abundance of Water, whereupon his Nauill ſuddenly opened, whence iſſued ſo great quantitie of the Dropſie Lye, that his Body fell to the wonted ſcantling, and he being aſſiſted by a diſcreete Phyſitian, recovered his health.

I ſaw (ſaith *Laurentius*) at *Mompelier*, a Dropſie Woman, whoſe Nauill in a tempeſtuouſ night, when ſhe thought little of it, opened, whereout flowed a great ſtreame of Water: early in the morning I was ſent for, together with *Bartholmew Cabrolins* a ſkilfull Anatomist: we found her Spirits almoſt ſpent by reaſon of the ſuddaine and immoderate euacuation; thoſe we preſently gaue order to reſreſh and re-eſtabliſh: which being done, ſhe perfectly recovered through Gods helpe, and yet continueth in good health.

Ludouicus Villonouanus a very learned Phyſitian, told me at *Gratianopolis* (ſaith *Laurentius*) that he knew a Country Peaſant perfectly cured by this kind of Section.

Balthazar Garielus my friend, and a learned Chirurgicalian of *Mompelier*, at my appointment, ſaith the ſame *Laurentius*, opened after this manner a Dropſie Patient, who was very importunate vpon vs; his Belly fell almoſt vnto the accuſtomed extent, and he ſeemed to be paſt all feare of Death. The tenth day after his Section, without any knowledge, he ate a pound of Cherries, hereupon he fell into a ſcouring, by which the frame of Nature was vtterly ouerthrowne, and ſo within two dayes he dyed.

By Reaſons

It is manifeſt therefore by experience, that this way Section may be ſafely adminiſtered: neither doth Reaſon diſſwade from it. For, as *Hippocrates* ſaith, *The way that Nature inclineth the Phyſitian muſt follow*; but Nature often-times findeth this way through the Nauill. Beſide, this kind of Apertion of the Nauill, excuſeth the Section of many parts. For, about the Nauill, doe meet the foure Nauill Veſſels, which if they chinke or cleaue, as they vſe to doe by the forcible confluence of Water to that part in Dropſie Bodyes, then there remaineth nothing to cut, but onely the Skin, and then the Water will iſſue forth.

Obiection.

But it will be obiected, that the *Chords* or *Tendons* of all the Muſcles of the *Abdomen*, doe meet about that place, and therefore if that place be wounded, it is a venture but Conuulſions will follow.

Answer.

We confeſſe indeed, that all the extreamities of the Muſcles doe determine in the White Line, but theſe extreamities about the Nauill are perforated, to make way for the Vmbilicall Veſſels, and therefore are not wounded in this kind of Apertion. Moreouer, thoſe which labour of this kind of Dropſie which is called *Aſcites*, almoſt all haue ſtrutting or ſwollen Nauils, the Tumor growing by reaſon of the confluence of Water to that part, ſo that if but the Skin be pierced with a ſharpe Inſtrument, then preſently followeth a Flood of Waters. Again, when the Section is thus made in the middeſt, the Patient may with eaſe lye vpon either ſide, which he cannot doe if the other kind of Section be adminiſtered.

The

The last question, was moued about the manner of this kind of *Paracentesis*, which is on this sort: You must first cast a Bought or running knot round about the Nauill, that at your pleasure you may streighten the hole or passage, if the Water should issue out with too great violence: next, with a sharpe pointed Nall or Bodkin, you must pierce the Skin in the very middle of the knot of the Nauill, against which, as we haue said, the Vessels doe chinke or cleaue in Dropsie Bodyes; and then put a Brazen or Siluer Pipe into the wound, through which the Water may passe, which also may be stopped at your pleasure; for all the Water must not at once be drawne out, but some and some by degrees. For *Hippocrates* saith, *That if the Dropsie water, or the Purulent Matter of an Empyeme in searching or cutting doe all at once issue forth, the Patient will dye*: For, it is a rule, *That all plentifull and suddaine Euacuations are dangerous*. And in another place, *Dropsie Waters must be by degrees euacuated*. Finally, it may seeme, that *Hippocrates* had some knowledge of this Apertion, because he saith in one place, *Apply your actuall Caustic about the Circumference of the Nauill, so let out your Dropsie Water, but burne not the part too deepe*. Haply, least they should not bee able to moderate the Effluxion.

The manner how to administer this kind of Apertion.

A caution.

Aphor. 27. Sect. 6. Aphor. 51. Sect. 2.

De Morbis Internis. De Locis in Homine.

The end of the Controuersies of the second Booke.





Of the Parts belonging to Nutrition or Nourishment.

THE THIRD BOOKE.

The Preface.



Having in the former Booke dismantled this Castle of the Body, and particularly the lower Region, we are now arrived at that Worke-House of Nature, wherein she hath built her Engines and Instruments by which she doth not onely nourish and sustaine the whole Family, but also perpetuate *Mankind* by propagation; the destiny of the Matter not admitting a perpetuities in the particular Creature. But because these two workes of Propagation and Nourishment are altogether distinct, if not in the Faculties being both naturall Alterations; the one called Generation, the other Assimilation; yet in the parts and organs thereto belonging: we have also thought good to divide them in our Discourse; and referring the worke of Propagation to afterward, in this place onely to handle the parts serving for Nutrition or Nourishment.

Seeing therefore the substance of the whole Body hath a necessarie diffuence and dissipation, as well by the in-bred heat, which like the greene Worme feedeth vpon the choicest Gems and Flowres, even the Radicall moisture, as also by the outward Aire, and other externall causes, and therefore cannot possibly either encrease to the iust extent or consist when it is growne, vnlesse the detriment and scath which is sustained by such dissipation and dissolution be restored and made good: Nature hath provided certaine nourishing Organs whereby that daily expence is continually supplied. And herein we have to admire the wonderfull providence of the great Creator, who hath disposed these parts wherein it was necessarie there should be such a confluence of noysome excrements in the lowest place, as it were in the Sinke of the Body, least otherwise their offensive exhalations should defile the Braine and the Heart, which are the Seats of the principall Faculties, or vitiate and disturbe the rest of the Senses. For this lower Region, is as it were the Kitchen of the House in which there are some parts, which as Cookes doe prepare the common dyet for the rest. But in the description of this Region, it must be remembred that we must not follow the order of Dignitie, or of Nature, but of Dissection, taking the parts according to their Position.

The Eye therefore falleth first of all into the snare of the Kell, and indeed it is of all things most like vnto a Snare or Purfenet, the close Meshes whereof, are purfled with curled Veines and curdled or crisped Fat, so becomming a thrummed Rugge to keepe warme the Membranous and vnbloody Guts and Stomacke vnder it. As for his duplecation, wherein the snaking and snayling diuarcations of the Vessels doe craule all ouer the Belly, I suspect it to haue beene ordained by Nature, for some more secret and mysticall end, then the securing of those tender Saplings, albeit I rest herein vnstatisfied for any thing I haue read.

Immediately

Immediately vnder these Cipresse wings (for wings they are called by the Anatomists) or Cauly cobwebs, appeareth the Maze or labyrinth of the guts wheeled about in manifold foulds and conuolutions, that neither the aliment should so suddenly passe away, and so the wombe of man become an insatiate Orque voyding whilst it doth deuour, neither yet the noisom steame of the Feculent excrements haue free and direct ascent to the vpper parts, but be intercepted and detained within those Meanders, and so smothered in those gluphs of the Guts, or let out at the port Esquiline. In the middest of the Guttes is scituated the Mesenterie, which we may call not the Midriffe, but the Midruffe, for it is most like vnto a gathered ruffe, sustaining the winding reuolutions of the Guttes in their proper places, & conuaying vnto them the Meseraicke veines, by which as by tender bearded rootes, the Aliment is conuayed vnto the gate of the Liuer: some haue called them *Baiuli domus*, the Porters of the house, because they continually carry the Aliment vnto that furnace, where it is tryed into blood. Neither are they idle and rigid passages, but as *Homer* feigneth that the instruments of *Vulcan* are moued by instinct and of their owne accord, so we may say that these vessels are taught by their Creator, not onely to leade along the *Chylus*, but to draw it and prepare it for the Liuer.

Next appeareth the *Pancreas* which wee call in Swine the Sweet-bread, a rude and vnshapely lumpe, most like a map or dish-clout, both in fashion and vse; or if you would liken it to any thing in the body, then it neereft resembleth the Liuer or cake of the wombe, which groweth to the rootes of the Infants nauell. It serueth for a pillow or Cushion, to boulder out the manifold diuisions of the Veines, Arteries, and Sinewes, which in that seat of the body are distributed vnto the adiacent parts; beside many other vses which we refer vnto their proper place: and passe along vnto the stomacke, the Cooke-roome, where Diet is the Steward, Appetite the Clark, and Concoction the maister Cooke. From thence the viands are deliuered vnto the Liuer, the principall part of this lower region, wherein they attaine their vttermost perfection, being depurated, from the scum by the bladder of Gall, from the residue by the spleene, from the vnprofitable liquor by the kidneies, which conuay it vnto the Cesterne of the bladder, to be cast out by the Conduite. Of all which if I should in this place vndertake to discourse, as it were easie for me, though briefly as I begā, yet the shortnesse of the partes of such discourse I see well would amount vnto too long a summe to bee comprehended in a Preface, especially considering wee shall at large prosecute euery particular in the following discourse: wherefore after we haue given you another kinde of distribution of them in the Chapter following, we will apply our selues vnto their particular Histories.

CHAP. I.

A distribution of the naturall parts contained in the lower Belly.

Having already intreated of the Inuesting or Contayning parts of the lower region or nether Belly, it followeth now that we continue our discourse to the parts contayned also. These are of double vse, for either they serue for nourishment, or for generation; those that belong to generation and propagation of the kinde, we refer vnto the next Booke. The nourishing parts doe either perfect the Chylus which we call Chilification, or the blood which we call Sanguification. For the first, some make and concoct the Chylus, as the stomacke; some helpe and further this concoction, as the Kell and the sweet-bread; others put to the last hand of perfection, and then distribute it, as the small guts; others receiue and auoyde the grosse and thicke excrements, as the great Guts and these together with the small, are fastned vnto the Mesenterie.

For Sanguification, some parts sucke the Chylus out of the Guts, alter it and giue it a certaine rudiment or tincture of blood, as the Meseraicke veines, which also carry it by the Port veine, vnto the gate of the Liuer, and thence into the substance thereof, where it receiue the perfection of blood. Others when it is thus perfected, doe distribute it into the whole body, as the hollow veine by his faire forked branches. Others receiue the excrements, either yellow choller, as the Bladder of Gall, and that which we call *Polus Biliaris*, & conueyeth it into the Guttes; or blacke and feculent choler, as the spleene or Milt, in which it receiue a farther concoction; and the more laudable part it referueth for his owne nourishment,

The parts belonging to nutrition.
To chilification.
Stomack.
Kell.
Sweet-bread.
Guts.
Mesenterie.
To sanguification.
Meseraicke Veines.
Gate veine.
Liuer.
Hollow vein.
Parts auoyding the excrements.
The bladder of gall.
The spleene.

Vas breue.
Hæmorrhoid.
veines.
Kidneyes.
Vreters.
Bladder and
yard.

rishment, but the very Lees it sendeth away either vpward vnto the stomacke by a short vessell called *Vas breue*, where it becommeth the Appetites remembrancer; or downward to the *Hæmorrhoidall* veines. Finally, the ferous or wheyie part of the bloud is still distilled away by the Kidneyes, wherein there is a segregation or separation made of that whay or vrine from the bloud; the bloud remaining behind for the nourishment of the Kidneyes, but the whay is deriued by the vreters into the bladder, from whence it is deliuered out by the Conduite.

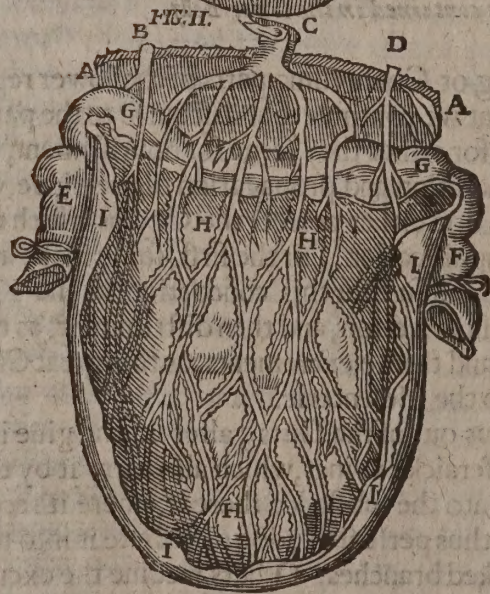
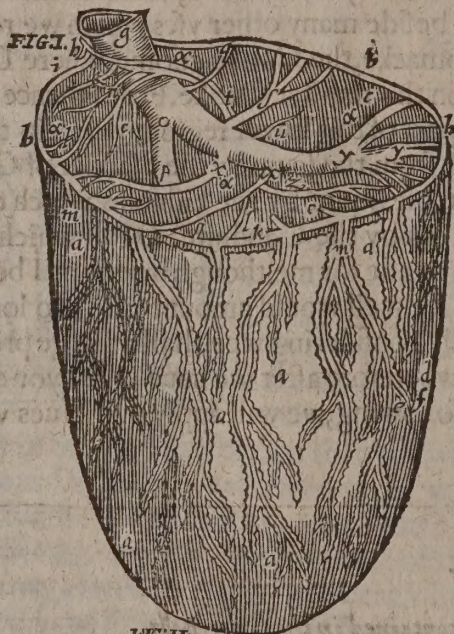
Of all which parts we will entreat as I said before, according to the order of Dissection, beginning with the Kell or *Omentum*.

CHAP. II.

Of the Omentum or Kall.

The names
& the reasons
of them.

The Kall or Kell which is deciphered in the sixt Table of the second booke, and in the first and second of this third booke, is called *Omentum*, as it were *operimentum*, that is, a couering: of the Greeks *ἐπιπλωον* of *ἐπιπλωω* to swim vpon, because it swimmeth vpon the bottome of the stomacke [Table 2 bb] and the vppermost guts [Table 2 cc.] From the wandring and implicated passages of his vessels, which may bee likened to a fishers net [Table 1. Figure. 1. and 2.] it



the stomacke. *HHH*. The lower part of the inner kall arising in some sort from the colick gut. *III*. The remayning portions of the vpper membrane of the kall torne off, that it may be shewne how the kall may be compared to a satchell or bagge.

Table 1. Lib. 3. The first figure sheweth the Kall or Omentum, whole and doosed on euery side, resembling a Satchell, or a small fishers Net; with the course of the Veines, Arteries, and Sinewes, running through it. The second figure containeth the lower membrane of the Omentum, the vpper being remooued with the Collicke gut which it containeth and the vessels.

- aaaa*. The outwards face of the vpper membrane of the Kall.
- bbbb*. The circle or girdle of the kall at which it growes.
- ccc*. The vpper part of the lower membrane about the colon.
- d e f*. Sheweth the membrane, vessels, and fat of the Omentum.
- g*. The trunk of the gate veine where it commeth out of the Liuer.
- h*. An arterie with a nerue reaching to the hollownesse of the Liuer, and the bladder of gall.
- i*. A vessell coming to the pylorus, especially on the back-part hauing an artery his companion.
- kk*. A vessell with a nerue which goeth to the right bottom of the stomacke.
- l m m*. Branches inwrapping the body of the stomacke from a vessell marked with *k*, which also goe through the vpper membrane of the kall *mm*.
- n*. A vessell reached out of the duodenum, and to the beginning of the empty gut, oftentimes hauing a small nerue to beare him company.
- o*. The diuision of the gate veine into the right and the left branch.
- p*. The right branch running into the mesentery and the guts.
- q*. A veine going to the backe parts of the stomacke.
- r*. A veine embracing the left mouth of the stomacke, in manner of a crowne.
- s*. The artery of the mesentery.
- u*. An artery going to the lower membrane of the kall.
- x*. A vessell sent with a nerue to the colon and to the lower membrane of the kall.
- y*. A vessell going to the lower Omentum.
- yy*. The course of the vessels of the spleene from the spleenicke branch.
- z*. A branch reaching to the left bottom of the stomacke.
- aa*. The Pancreas or sweet-bread vnder the vessels and the duodenum.

The second Figure.

- AA*. The vpper part of the lower kall arising from the back, which behind is vnder the stomacke, and with two membranes comprehendeth or embraceth the colon at the bottom of the stomacke.
- B*. A veine coming from the left trunk of the gate veine and the arterie, with a nerue for the most part tied vp to it, going into the kall.
- C*. A notable veine and an arterie communicated to the kall and the collicke gutte, to which a small nerue is added in some steads.
- D*. A veine running along the left side of the kall.
- E*. The right side of the collicke gut which lyeth vnder the hollownes of the liuer here cut away.
- F*. The left side of the collicke gutte which lyeth vpon the spleene.
- GG*. A part of the collick gut running along vnder the bottom of the stomacke.

is

is called *rete* or *reticulum*, for that saith *Archangelus*, as a net intangleth the fishes, so in this Membrane the Fatty vapours are intercepted and stayed. The Arabians call it *Zirbus*, the Latines *Mappa ventris*, the dish-clout or map of the Belly, because it licketh vp the superfluities thereof. All the sanguine or bloody parts almost are couered heerewith, but ouer some it is more fatty, ouer others more membranous. Amongst all creatures it is greatest in Men and Apes; and of Men, those that liue a sedentarie and idle life, sacrificing to their appetites, haue it so great, that it becommeth a burthen vnto them, whereupon they are called *Epiplocomista*, that is, Kal-carriers: but those that vse great exercises, as Hunters and such like, haue it more membranous, and lesse fatty.

It is a large membrane, scituated before vpon the bottome of the stomacke, [Tab. 6 PP. Fig. 2.] and downeward ouer the guts [Table 6. KKKK Fig. 2.] vnto the Nauill. Sometimes, but seldome, and that in Apes and Dogges it is stretched euen vnto the sharebone; and vsually in dissections it is obserued to bee rowled vp, or doubled towards the spleene, not onely in such as are hanged or drowned sayeth *Vesalius*, but also in those that dye of other ordinary diseases, or come to their ends by sodaine mischances. Sometimes also it insinuateth it selfe into the conuolutions or windings of the guts, and sometimes in Women it passeth betweene the bottomes of the wombe and the bladder, and by straightning the mouth of the wombe becommeth an ordinary, but yet not a perpetuall cause of barrenesse or sterility, as also *Hippocrates* obserued in his booke *de natura Muliebri*. In some women after their trauell, it remaineth gathered together about the middle of their Bellies, and there is the cause of sore paynes. But if it fall into the passage that descendeth into the Cod, it causeth a soft rupture, which disease no creature is subiect vnto but Men and Apes, as sayeth *Galen* in the third Chapter of his sixt booke *de administrationibus Anatomicis*.

It is fastned alwayes to the stomacke [Table 6. MN O Fig. 2.] to the Spleen and the Collicke gut [Tab. 1. Fig. 2. GG HH] to other parts sometimes it is ioyned, sometimes it is free from them, for it behooued not saith *Galen* in the 11. chap. of the fourth booke *de usu partium*; that it should hang loosely, lest it should be crumpled together, and should leaue many parts vncouered, which stand in neede of his warmth.

The forme of it is likest to a Purse-net or Faulknors bagge, [Table 1. Figure 1. and 2. 11] consistng of a double membrane knit together in the bottome; *Columbus* saith, but onely reflexed or turned backe againe. It hath a round orifice [Table 1. Figure. 1. bb] which ascendeth higher in the hinder part then before, and belowe it is round [Table 1. Figure 1. and 2.]

It is compounded of membranes and vessels, and a muddy and easily putrifying Fatte, which composition *Galen* expresth vnder the name of his original, in the place next aboue named. The Membranes are two (whence of some is called a double *Peritoneum*) and those very fine and smooth (least the guts should be ouer burdened with his waight) lying one vpon the top of another; the vpper is called the vpper wing, the lower the lower wing [Tab. 2. cc.] The vpper and formost ariseth at the bottome of the stomacke [Tab. 2. aa. bb.] from the *Peritoneum* which compasseth it about, and maketh his third coat, and is ioyned in a right line, with a portion of the inferiour membrane in the hollow parts of the Liuer and the spleene. The lower and hind-most wing ariseth from the *Peritoneum* at the backe [Tab. 1. Fig. 1. ccc] presently vnder the midriffe; and being led to the hollow side of the liuer, it cleaueth (yet but seldome) to a part of it, as also to the midriffe, to the right side of the stomacke, almost to the whole gut called *duodenum*, and to the hollow part of the spleene; and groweth fast to the stomacke, and to the collicke gut, [Tab. 1. Fig. 1. GG.] all the way the same is annexed to the bottom of the stomacke, so that to that gut it is as it were [Table 1. Fig. 2. HH] a mesenterie. In Dogs it is neither tyed to the Colon, nor to any other gut; in Apes onely to the right part of the Colon.

Many veines (but onely from the port veine) passe through both his wings. Through the vpper from two veines which passe by the bottome of the stomacke (which are called the right and left [Table 2. H and X] *Gastra epiplois*) infinitely propagated obliquely downward. [Table 1. Fig. 1. KK MM.] Through the lower wing from those veines which passe into the spleene [1. Fig. 1. u x Fig. 2. BC D] which are diuersely spread, sometimes with a foure-fold branch (as in the history of the Port veine shall bee sayd) for the nourishment of the adiacent parts.

They are sprinkled also with many Arteries [Tab. 1. Figure 1. u Figure 2. c] from the Celiacall

Archangelus

Kall carriers.

The scituati-
on of the Kall.

Vesalius.

Hippocrates

Galen

His connexion.

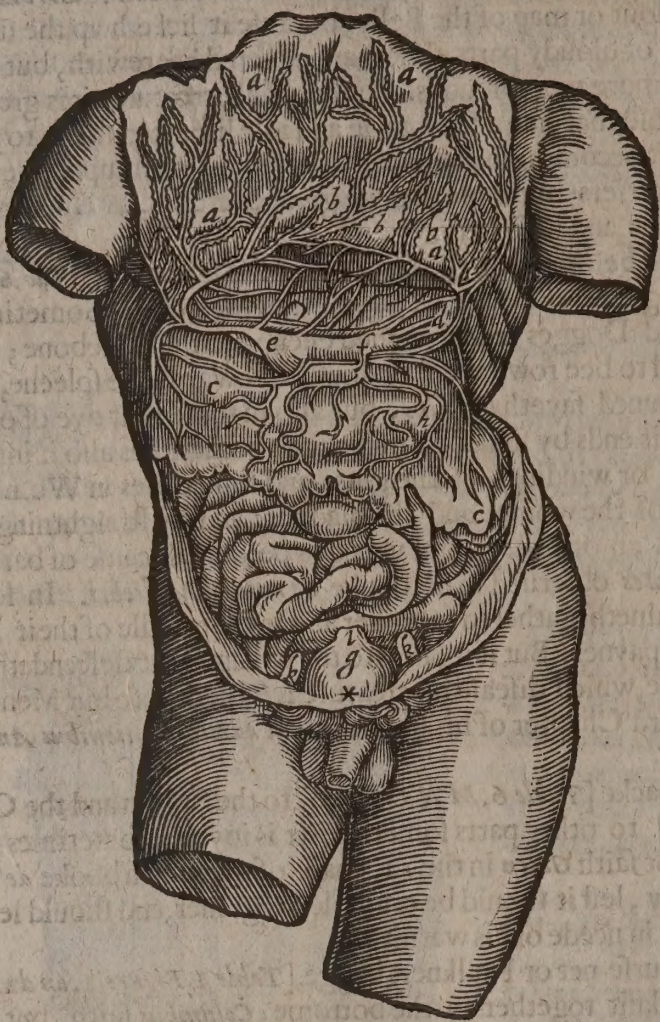
The forme of
it.The frame or
composition.His two mem-
branes.

Connexion.

His vessels
veines.

Arteries.

TABVLA II.



The lower belly, with the upper Membrane of the Kall torn vp, and turned about the outside of the Chest and the stomacke, the stomack also removed out of his seat to the Chest, that the lower Membrane of the Kall might the better be perceived, as also the guts remaining in their naturall position, and a part of the spleen, are herein deciphered.

aaaa. The inside of the vpper membrane of the kall, which som call *alam superiorem* the vpper wing.

bb. The stomack strutting out covered with the vpper membrane of the kall.

cc. The lower membrane of the kall, or his nether wing gathered vpward.

d. Vessels passing to the spleen which appeareth bunching vnder the *Omentum* at *b*.

e. The trunk of the gate vei ne.

f. The spleenick branch of the port vei ne.

g. The bladder of vrine.

h. The seate of the spleen.

i. The vessels called *Vrachos*, by which the Infant is nourished in the wombe.

kk. The two vmbilicall arteries.

Nerues.

liacall and mesentericall branches to giue them life; but their nerues from the Ribbe-branch [Table 1. Fig. 1] of the sixt paire are wondrous small, but finely scattered that they might not be altogether without sence.

The fat of the Kell.

The Fat is very plentiful about the vessels [Tab. 1. Fig. 1. d e f] but in the distance betwixt them, none at all. In an ordinary fat man it may amount to a pound, or a pound and a halfe; and amongst it do runne innumerable glandules or kernels, which sucke vp the faeculent moysture, which is separated in the first concoction. Wherefore seeing it is not ingendered of any portion of the blood, as that fat called *pinguedo*, or as other fats, therefore it easily putrifieth, so that if vpon a wound it fall out of the body, it becommeth presently rotten, which hapneth not to the other fats vnder the skin, or in other parts.

The vse of the fat of the Kell.

The vse of the Fat of the Kall, is to cherish and to comfort the bottome of the stomack, (for the vpper part thereof is warmed by the Liuer which lyeth vpon it, and therefore it is that the Kall attaineth not so high) as also to increase the heate of the guts: for both these parts are membranous and without blood; and therefore their naturall heate is but weake. Now this comfort the Kall affoordeth not onely by his owne heate, which yet is the more, because of the manifolde Veines and Arteries which are wouen together through his substance: but also because beeing thicke and bedded together, it much hindereth the heate from dissipation, and the incursion also of outward colde, and so by consequence is a great helpe and furtherer of concoction. And that it was ordayned to increase heate, *Galen* in his fourth Booke *de vsu partium*, and in the ninth Chapter, maketh manifest by the example of those, who hauing got a deepe wound in their bellies, so that a part of the Kall falleth out, do euer after worse concoct their nourishment, and stand in need of Stomachers or other coverings vpon their bellies to keep them warme, especially when much of it falleth out; for

for it presently groweth liuid, & constraineth the Chirurgion to take it off, so saith *Hippocrates* in the beginning of his first Booke *de Morbis*, If the Kall fall out, it putrifieth necessarily. And *Galen* in the place before named saith, he tooke almost all of it from a Fencer, who was presently cured, but euer after was easily offended with colde, so as he was constrained to defend his belly with Wooll. Heereto also *Aristotle* assenteth in the third Chapter of his fourth Booke *de partibus Animalium*, Nature (saith hee) abuseth the Kall to helpe the concoction of the Aliment, that it might be done with more ease, and greater expedition. For heate concocteth: now that which is fat is hot, and therefore the Kall beeing fat, must needs concoct.

Hippocrates
A story out of
Galen.

Aristotle.

Another vse of the Kall is to keepe the guts moyst, because they are often distended, and againe corrugated, as they are filled with *Chylus*, or emptied of it againe. A third vse is, that in time of necessity and affamishment, saith *Galen* in the xi. Chapter of the fourth Booke *de usu partium*, it might supply a kinde of subsidiary nourishment to the naturall heate.

Galen

The vse of the Membranes of the Kall or Kell, is to sustaine the branches of the Gate Veine, & the Cæliacall Arterie which passe into the Stomacke, the Spleene, the Gut called *Duodenum*, and the Collicke gut. Againe, to knit the stomacke, the *duodenum*, and the Collick guts vnto the backe. To couple together the Liuer and the Spleene.

The vses of the
Membranes of
the Kell.

Archangelus addeth, That the thicke and bloudy vapours arising from the parts contained in the lower belly, might cleaue into these Membranes, and by their density and thightnesse or fastnesse be condensed or curdled into fat, that so good a vapour as might afterward bee turned into nourishment, should nor vapour out in vaine. Finally, *Laurentius* addeth another vse of the Membranes out of *Hippocrates* Booke *de Glandulis*, That when the humour which commeth from the Guts, is so plentifull that it cannot be receiued and assumed into the Glandules, the ouer-plus might be referued in the Membranes of the Kell.

Archangelus

Laurentius out
of *Hippocrates*.

CHAP. III.

A briefe Description of the Gate-Veine and his Branches.

Now because the branches of the Gate-veine, and the Cæliacall or Stomacke Arteries must be demonstrated by order of Dissection before we come to the Guts, or else they will be offended, I haue thought it not amisse to giue you a briefe description of them in this place, referring the larger and more exact discourse vnto the proper history of the Veins and Arteries. First therefore the Gate-veine (so called, because through a gate the Chylus is conueyed into the Liuer) ariseth out of the hollow part of the Liuer, betwixt the two small eminencies or swellings thereof which *Hippocrates* calleth *Portas* the gates. Some thinke, it is propagated from the vmbilical veine which proceedeth out of the cavity. We will diuide it into the Trunke and Branches. The trunk before it is diuided [Tab. 3. B] sendeth forth two small shootes from his fore-part called *Cystica Gemella*, or Twin-veines of the Gall, [Tab. 3. CC] which passe vnto the bladder of Gal. The second is called *Gastrica dextra*, the right stomacke Veine [Tab. 3. D] which goeth vnto the backe part of the stomacke, and the *Pylorus* or mouth of the same.

Why we treat
of them in this
place.

The Originall
of the Gate-
Veine.
Banhuine.

Cystica gemella

*Gastrica dex-
tra*.

The branches are some of them vpper, some neather. The vpper branches which we call the roots of the Gate-veine, [Tab. 3. AAAA] are disseminated through the hollow part of the Liuer, and do make one Trunke [Tab. 3. BCDE] These roots are by *Anastomosis* ioyned with the roots of the hollow Veine.

The nether brances shoot out on the right side or on the left, from the right side three branches.

The first, called *Gastroepiplois dextra*, the right stomacke and Kall veine [Tab. 3. H] attaineth from the right side of the trunk, to the bottome of the stomacke, and the vpper membrane or wing of the Kall.

*Gastroepiplois
dextra*.

The second is called *Intestinalis* or the Gut-veine [Tab. 3. I] because it is conueyed vnto the middle of the *duodenum*, and the beginning of the *Jejunum* or empty gut.

Intestinalis.

The third is called *Mesenterica*, or the veine of the Mesentery [Table 3. b.] which is subdivided into three veines: two of the right hand called *Mesenterica dextra*, which are distributed into the guts called *Jejunum*, *Ileon*, *Cæcum* and a part of the collick gut, where becomming very slender and fine like bearded roors of a tree; they make those veines which we commonly call the Meseraick veines [Tab. 3. dddd] which passe between the two mem-

*Mesenterica
dextra*.

Table ij. sheweth the Vena porta, or Gate-veine with his branches, which he sendeth to the bladder of Gall, to the stomacke, to the Splene, to the mesentery, and to the Guts.

TABVLA III.



- 1, 2, 3, 4, 5. The vpper branches of the Gate-veine, disseminated thorough the Caud of the hollow parts of the Liuer. *AAAA.* Their distribution maketh the forme of the Liuer.
- B. The trunk of the Gate-veine coming out of the hollow part of the Liuer.
- CC. The two twin veines of the Gall, called *Cystica Gemellæ*.
- D. The right *Gastrick* or stomacke Veine.
- E. The diuision of the trunk of the Port-veine into two branches.
- F. The left branch, which is the vpper, and is called the Splene branch.
- G. The right branch, which is the greater and the lower, called the Mesentericall branch.
- H. The right stomack Kall-veine, called *Gastroepiplois*.
- I. The Gut-veine called *Intestinalis*.
- K. The lesser stomacke veine, called *Gastrica minor*.
- L. The right Kall-veine called *Epiplois dextra*.
- M. The sweet-bread-veines called *Pancrea*.
- N. The great stomack-veine called *Gastrica maior*.
- OO. Two veines of the last named branch, inwrapping the backside of the stomacke.
- P. The Bifurcation or partition of the great stomacke-veine in the vpper part of the stomacke.
- Q. The Crowne veine of the stomacke called *Coronaria stomacica*.
- R. A branch of the Crowne-veine passing along the vpper side of the stomack, and giuing branches to the *Pylorus* or mouth of the stomacke.
- S. The backward or hinder Kall-veine called, *Epiplois postica*.
- T. The diuision of the Splenicall branch.
- V. The left Kall-veine called *Epiplois sinistra*, whose root in the great figure is at V. but his distribution is well shewne in the small figure by V. and T.
- X. The left stomack-kall veines, called *Gastroepiplois sinistra*.
- YZ. The veines which runne vnto the left side of the stomack turned backe from them which go vnto the vpper part of the Splene, and the vpper Z. of the two sheweth the vessel called *Vas breue* or the short vessel, whereby the melancholy passeth out of the Splene into the stomack, and this is the reason why melancholy people haue alwaies crasie stomackes.
- aaaa. Small branches running through the substance of the Splene, making the forme of the splene.
- b. The right Mesentericke veine.
- c. The left Mesenterick.
- ddd. The Mesentericall veines.
- ee. The Veine which belongeth to the Collick gut.
- ff. Veines belonging to the right Gut.
- gg. The Hemorrhoidall veines which compasse the Fundament; but these shall bee more lively described heereafter.

branches of the Mesentery, and gaping with open mouth at the coate, not at the cavity of the Guts; do sucke from them the *Chylus*, to which they afford a certain rudiment or beginning of blood, and then conuey it to the Liuer, or rather into the rootes of the *Porta*, which are disseminated in the Liuer. From whence a part falleth out into the substance of the Liuer for his Nourishment, the rest is driven into the hollow Veine, to be communicated to the whole body. Moreouer we must know, that the very same Mesentericke veines which carry the *Chylus* thus vnto the Liuer, do also bring from the Liuer vnto the Gutes, perfect blood for their nourishment at the very same time; the veines of the Liuer drawing the *Chylus*, and the Gut drawing the blood.

The third Mesentericall veine, is called *Mesenterica sinistra*, and is disseminated into the left [Tab. 3. C] and middle part of the mesentery. From this commeth the *Hemorrhoidalis interna*, the inward Hemorrhoidall vein, [Table 3. gg] (for the externall proceedeth from the Hypogastricall branch of the hollow Veine) and descendeth by the end of the Collicke [Tab. 3. ff] vnder the right Gut, whose extremity it compasseth with small Tendrils, by which the Hemorrhoides do flow. And thus much of the branches which proceede out of the right side of the trunk of the Gate-veine.

Out of the left side issueth the splenicall bough, and from it many propagations, some before

Mesenterica sinistra.
The Hemorrhoid. Veines.

Mesenterica sinistra.

fore, some after his diuision: before his diuision spring five branches.

The first called *Gastrica minor & sinistra*, the lesser and left stomacke veine [Table 3. K] *Gastrica minor* goeth vnto the back part of the stomacke.

The second called *Gastrica maior* [Tab. 3. N] creepeth vnder the stomacke to his vpper orifice with three branches; the middle of which is called *Coronaria Stomachica*, the Crowne veine of the stomacke [Table 3. Q] because it doeth incompass the vppermost mouth thereof.

The third is called *Epiplais dextra*, the right Kell veine [Table 3. L] this attayneth vnto the right side of the lower wing of the Kell and to the Collicke gut. *Epiplais dextra*

The fourth called *Epiplais postica*, the backward Kell veine [Table 3. S] passeth with a double branch, one on the right hand, another on the left, to the vnder wing of the *Omentum* or Kell, and a part of the Collicke gut. *Epiplais postica*

The fift is manifold, called *Pancrea* [Tab. 3. M] because like smal haire they passe vnto the *Pancrea* or sweet-bread; and these are the branches which doe issue before the diuision.

After the diuision from the vpper braunch neere the superior part of the spleene, springeth a notable veine, commonly called *Vas breue*, the short vessell [Table 3. Z] which is inserted into the left side of the bottome of the stomacke, by which the melancholy bloud is belched out into the mouth of the stomach, to strengthen it by his adstriction, to further the principall action of the stomacke which is concoction, and to prouoke appetite. *Vas breue.*

From the lower branch proceed two veines: the first called *Epiplais sinistra*, the left kel *Epiplais sinistra* veine [Table 3. V] which passeth to the left side of the lower wing of the *Omentum*.

The second is called *Gastro Epiplais sinistra*, the left stomacke and Kell veine [Tab. 3. X.] *Gastro epiplais sinistra.* It ioyneth it selfe with the right, and compasseth the bottome of the stomach; the remainder of them both after their copulation, is diuersly distributed [Tab. 3. YZ] into the middle line of the spleene: and so much of the Gate veine and his branches.

CHAP. IIII.

Of the Arteries called *Celiaca*, and *Mesenterica*: that is, the Arteries of the Stomacke, and the *Mesenterie* which accompany the branches of the Gate veine.



HE Arteries which accompany the branches of the Gate veine before described are three. The first is called *Celiaca*, or the Stomacke Arterie [Tab. 4. Fig. 1. m] and the other two, *Mesenterica superior*, or the vpper *Mesenterical* Arterie [Tab. 4. Fig. 1. n] and the lower [Tab. 7. 10.] called *Mesenterica inferior*.

The *Celiacall* or Stomacke Arterie [Tab. 4. Fig. 1. m and Tab. 7. 6] is so called because it sendeth many branches to the stomach. It is a notable branch of the great Arterie, and every where accompanieth the branches of the Gate veine. His originall is from the foreside of the *Aorta*, where it leaneth vpon the back-bone, and is supported with the lower wing of the Kell, till it come to be diuided into two branches: the right [table 4. Figure 1. n] is lesser, and the left [table 4. Fig. 1. n] somewhat larger. *Celiaca.*

The Right branch [table 4. Figure 1. n] [as it goeth vpward to the hollownesse of the Liuer, sheddeth small furcles out of it selfe, some from his vpper part, and some from his lower. The right branch.]

From his vpper part two: First, the right *Gastricke* or Stomacke Arterie [table 4. Figure 1. p] is distributed into the lower part of his right Orifice. Secondly, *Cystica gemella* [table 4. Figure 1. f Figure 2. x. table 7. 8.] two small Arteries creeping to the bladder of gall. *Gastrica dextra.* *Cystica gemella.*

From his lower part three: First, the right Kell Arterie [table 4. Figure 1. o Figure 2. h] attayning to the right side of the Kell and the Collicke gut. Secondly, the gut Arterie [tab. 4. Figure 1. q Fig. 2. d] reaching to the *duodenum* and the beginning of the *Ieiunum*. Thirdly and lastly; the right stomacke and Kell Arterie [table 4. Figure 1. r] which is fastned to the vpper Kell, and sprinkleth many branches to the foreside and backside of the bottome of the stomach. *Epiplais dextra.* *Intestinalis.*

That which remaineth of the right branch, determineth in the hollow of the Liuer [tab. 4. Figure 1. y table 7. 7] by which it recciueh life. *Gastro epiplais dextra.*

The left branch [table 4. Figure 2. n] called *Arteria splenica*, passeth obliquely through the *spleen*. *Arteria splenica.*

Table iij sheweth a part of the Trunke of the great Arterie, out of which the Arterie Calliaca proceedeth; and beside it sheweth the branches of the Calliaca Arterie, which do accompany the Branches of the Veine.

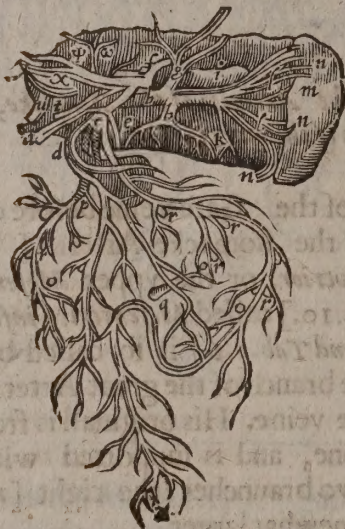
The second Figure sheweth the mutuall connexion of the Calliaca Arteries, with the sweet bread and spleene.

TABVLA III.

FIG. I.



FIG. II.



- g The arterie belonging to the short vessell which passeth from the spleen to the stomach, called *vas breue arteriosum*.
- m The place where the Calliaca Arterie ariseth.
- n The right branch of the Calliaca.
- r The right kal. arterie, as it is disseminated into the lower membrane of the Kall.
- p The right stomacke arterie running into the right side of the back of the stomach toward the *Pylorus*.
- q The gut arterie which reacheth to the gut called *duodenum* and to the beginning of the *scinum* or empty gut.
- r The right stomacke-kall arterie which is disseminated into the right side of the bottome of the stomacke, and into the vpper membrane of the kall.
- f The two twin arteries of the gal, how they passe vnto it.
- e Arteries distributed into the hollow part of the Liuer.
- n The left branch of the Calliaca or *Aluna*, which goeth especially to the spleen.
- x The greater stomacke arterie which goeth to the hinder side of the stomach, and to his left orifice.
- y Certaine shootes sent into the middest of the stomacke where it is tied to the backe.
- e The Crowne arterie of the stomacke, which circleth the left Orifice of the stomacke.
- e The left stomacke arterie which goeth into the vpper parts of the stomacke at the right orifice.
- β The back or hindmost Kall arterie, which is distributed into the lower membrane of the Kall and the collick gut.
- γ The left kall arterie which goeth to the lower membrane of the kall.
- aa Branches which passe into the hollownes of the spleene.
- e The left stomack Kall arterie going to the left side of the bottome of the stomacke, and the vpper membrane of the kall.
- e The vpper mesentericall arterie.
- n The right and the left emulgent arteries as they goe to the Kidneys.
- xx The right and the left spermaticall arteries.

The second Figure.

- aa The veine, the arterie, and the nerve, which fould themselves in the *Pylorus* or mouth of the stomacke.
- b The lesser branch of the Gate veine, or the spleenick branch.
- c The greater branch of the Gate veine or the mesentericall branch.
- d A veine and an arterie going to the gut called *duodenum*.
- e Vessels going to the lower membrane of the Kall.
- f The roote of the arterie which accompanieth the branches of the gate veine.
- g The *Coronarie* or crowne veine and arterie of the stomacke.
- h Vessels going to the lower Kall, and to the collick gut.
- i The sweet bread or *Pancreas*, vpon which the vessels are for security distributed.
- k A veine going to the left side of the lower Kall.
- l A company of vessels which passe vnto the spleen.
- m The inflexion of these vessels.
- nnn Vessels reflected from the former, and offered to the stomach.
- ooo Veines and arteries sent to the gut.
- pp Two arteries going to the mesentery.
- rrrr The glandules or kernels of the mesentery, which lie vnder the vessels for their security.
- s The trunk of the gate veine.
- u The hole of the bladder of gall where it openeth into the gut called the *duodenum*.
- x The veines of the bladder of gall.
- y Arterie and nerves that go to the liuer and the bladder of gall.
- z Two branches which run vnto the back parts of the stomach.
- * The *Hæmorrhoides* veine and arterie.

the *Pancreas* [tab. 4. fig. 2. i.] to the Spleene. [table 4. fig. 2. m.] It is larger then the right branch, that it might not easily be obstructed; for it conueyeth vitall spirits to the spleen, & also belcheth out into it the more fæculent part of the bloud contained in the great Arterie. This Arterie is continually ioyned vnto the spleenick veine described in the Chapter going before, and hath so many branches, and in the same order of position, as also named by the same names, which we will runne breiefely ouer in this place.

Gastrica sinistra
Ar.

Gastrica sinistra vel minor, the left or lesser stomacke Arterie [table 4. figure 1. a] turneth on the right hand to the vpper parts of the stomacke.

Gastrica maior

Gastrica maior [table 4. figure 1. K] offereth a branch to the backside of the stomacke, as also to the midst thereof marked in the fourth Table at [y], out of this also ariseth the crowne Arterie [table 4. figure 1. 2.] answering the crowne veine before described.

From the lower part.

Epiplois postica

Epiplois postica [table 4. fig. 1. B. fig. 2. C] diuided into two stradling branches, which are propagated into the lower wing of the Kall and the Collick gut thereto adioyned.

Epi-

Epiplois sinistra [Tab. 4. Fig. 17] passeth also to the lower *Omentum*, and runneth into the left side thereof.

The remainder of this branch [Tab. 4. Fig. 17] attaineth to the Spleene, and is diuided into an vpper and a lower branch, and these into others, till at length they reach vnto the hollow side of the Spleene, [Tab. 4. Fig. 18] From whence [do] proceede *Gastroepiplois sinistra*, [Tab. 4. Fig. 18] which is sustained by the vpper wing of the Kell, and so goeth vnto the left side of the bottome of stomake.

Also *Vas breue Arteriosum* [Tab. 4. Fig. 17] passeth out of the vpper part of the Spleen, and is inserted into the left side of the stomacke.

The Mesentericall Arterie is double, both of them proceeding from the fore-side of the trunk, the vpper below the *Celiacæ*; the lower below the spermaticall Arteries.

The vpper [Tab. 4. Fig. 17] Fig. 2. P. Tab. 8, 10.] is propagated into the vpper part, and almost into the whole Mesentery, and reacheth his manifolde furcles to the empty gut, the *Ileon*, and a part of the Collicke gut, where it approacheth the right Kidney.

The lower [Tab. 4. Fig. 17] Fig. 1. Q, Tab. 8, 2] Mesentericall Arterie, runneth vnder the lower end of the Mesentery, and especially to the left side of the Collicke gut and the right gut, and maketh the Hemorrhoid vessell, together with the Veins, & it is noted in the second figure of this fourth Table at this marke*. And so much at this time shall suffice to haue spoken of the Gate veine, and the *Celiacall* Arterie in this place, considering that we shall haue fitter occasion to prosecute their branches heereafter. Now we will proceede vnto the guts.

CHAP. V. Of the Gutes.

THe Gutes are called in Greeke *ἔντερα*, and *Intestina* in Latine, because they are placed in the inmost part of the body, and doe take vp the most part of the cavity of the lower belly. [their naturall position appeareth in the 2. & 5. Tables,] And because they farre exceed the length of the same, they are necessarily gired and rouled into manifolde Conuolutions, [Tab. 2, 5, & 6.] that it might containe them, as we vse to rowle vp a rope if we would put it into a bag or quoye a Cable. They are knit together by the benefite of the *Mesenterium* [as appeareth in the 7. Table,] by which also, and the interposition of the *Omentum*, they are tied to the backe, and are held vp or supported by the cavities or hollownesse of the hanch bones.

They are long bodies, and commonly fixe times so long as the man whose entrals they are, round they are and globous, that they might bee more capacious and lesse subiect to outward iniuries; Hollow, but not all of a bore as wee call it, carried also in circular conuersions (excepting their beginning [Tab. 6. Fig. 1, 2. at 1 and A] and their end, that the entrance and out-gate of the Aliment should not bee interrupted) lest the nourishment should too suddenly slip away before the *Chylus* be fully distributed, and constrain a man est-soones to call for more, and so be the cause of insatiable gulosity or raueness, which would, as *Plato* saith, interrupt all good and liberall learning. For so we see those creatures whose guts from the stomacke to the sledge are either streight or lax; are insatiable deuourers, which also *Aristotle* witnesseth in his third Booke *de partibus animal.* chap. 14. for the loosenesse or laxnesse of the gut encrease, and the rectitude of it hastneth the desire of meate. Wherefore those creatures whom it became to bee more moderate that way, haue more of these circumuolutions, which also make them able longer to containe the excrements, that they shold not be enforced but at their own pleasure to vnburden themselves; for those creatures that continually put in, must haue answerable euacuation.

The guts are continued with the stomack at the right Orifice called the *Pylorus*, but their substance is thinner then that of the stomack, and by reason of the innumerable veines that are inserted into *Ieiunum* & *Ileon*, which do in a short time suck it, they receiue much nourishment, which presently by as many vessels is conueyed to the Liuer. This speedy distribution of the nourishment could not be, if it went out of one stomacke into another, because there would not be space for the insertion of such a world of veines, and so the distribution must needs be slower, and beside much of the Aliment would escape the Veins, vnlesse it were est-soones all the way of the passage againe and many times as it were reui- sed, till there were nothing left but bare excrement.

And albeit there be but one *ductus* or through-passage from the *pylorus* or mouth of the stomack

Epiplois sinistra

Gastroepiplois sinistra

Vas breue arteriosum

Arteria Mesenterica

Superior

Inferior

The Names.

Their Connexions.

Their length.

The reasons of their length.

Plato.

Aristotle.

The veines of the guts called Mesentericks.

stomacke euen to the sledge, that it may not amisse bee called one gut; yet because the parts of it do very much differ in substance, figure, office, place, magnitude, and in number of circumuolutions and turnings: therefore first in respect of their substance, there are two sorts of guts. One slender, fine, and small, which *Galen* calleth *μικρά τήλεα, λεπτά. Plan.* *tas* calleth them *Lactes* of the old word *Lacio*, which signifieth to draw, because they draw the *Chylus* more powerfully then the other which are thicke and crasse, called by *Hippocrates*

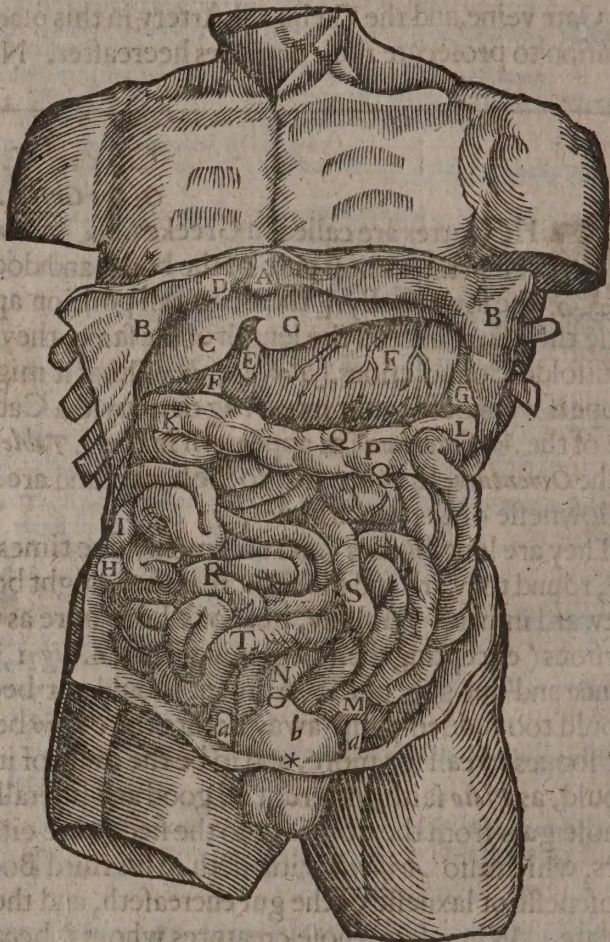
The small guts.

The slender or smallest sort of Guts is three-fold, *Duodenum*, *Jejunum*, and *Ileon*, which though they haue all almost one capacitie or amplitude, yet they are easily distinguished by their scituation, length, and by their Meseraick veines. And beside, the *Jejunum* about his beginning, where it is tyed to the backe, is sometimes obserued to be enlarged.

Tab. 5. sheweth the Bowels of the Lower belly, euerie one in their owne place. The ends of the lower Ribbes, together with the Midriffe and the Peritonaum adhering there to are turned backe, that the Liuer, the Spleene, and the stomacke might be better seene.

- A. The Brest blade cald *Cartilago ensiformis*.
 BB. The *Peritonaum*, together with the Midriffe and the broken ribs bent outward.
 CC. The *Gibbons* or buching part of the Liuer.
 D. A Ligament tying the Liuer to the Midriffe.
 E. A part of the vmbilicall veine.
 FF. The stomacke filled full of meate.
 G. A part of the Spleene.
 H. The blinde gut of the late writers: for the ancients tooke the top of the Colon for it.
 I. The beginning of the great or thicke guts.
 I. and so to K sheweth the passage of the Collick gut from the right kidney to the Liuer, and so the Collicke and the stone on this side are in one place, and therefore hardly distinguished.
 K. to L. the same Collicke Gut lyeth vnder the whole bottome of the stomach, which is the reason that those which are troubled with the Collick cast so much.
 L. to M. The passage of the Colon, from the spleene vnto the share bone by the left kidney a-way, which maketh the payne of the Stone and the Collicke on the lefte side, very, harde to distinguish.
 N. The Colon ending into the right gut.
 O. The beginning of the right Gut vnto the bladder.
 P. Q. The sunken or fallen side of the Colon at P. and his Chambers and pusses at Q.
 RST. The lesser Gutes, especially lying vnder the Nauell.
 aa. The two vmbilicall arteries.
 b. The bottome of the Bladder.
 * The Connexion of the bladder and the *Peritonaum*.

TABVLA. V.



The great guts.

The thicke or great guts are as many [Tab. 6 Fig. 2, 3.] called *Cacum*, *Colon* & *Rectum*, all differing in scite, figure, and maginitude. For the *Colon* and *Rectum*, that is, the Collick and the right guts, are more ample then al the rest. For the figure, some are right as it were by a line, as the *Duodenum* and *Rectum*, the rest are full of turnings, and as it were chambered more or lesse.

Their offices.

In respect of their offices, some are appointed both for the persifting and for the distributing of the *Chylus*, to wit, the smaller and narrower, that so the smallest crumme of the meate may meete with their sides and vessels; others are appointed for baser vse, to gather together the excrements, as the Crasse or thicke guts.

Their scituation.

The smaller, partly by reason of their excellency, partly for their commoditie, do occupy the middle place [Tab. 5. RST, Tab. 7. CCCC] euen all the Regions of the nauell & the *Hypogastrium*, yet in dogs it is not so, which deceived the Ancients, who called the small the

upper

upper guts, the thicke the lower; which order we finde different in man, whose Colon occupieth the vppermost place, and passeth vnder the bottom of all the stomacke. For their commodity they are placed neare the Center of the Mesenterie [Tab. 7. H] that the mesentericall branch might without any great distance be conuayed vnto them, and so the Chylus quickly transferred to the Liuer.

The thicker guts are placed towards the sides [Table 5. Table 6. Figure. Table 7. EEEE] partly because they might giue way to the smaller; (the Colon also is knit to the bottome [Table 5. E] of the stomacke) partly that like a munition or defence they might compasse and defend the smaller, least they should bee pressed or streightned. They were also made large, that they might containe the greater quantity of excrements, before they were provoked to excretion.

The first of the slender guts [Table 6. figure 1, from I to K] which Herophilus calleth *δωδεκαδάκτυλον*, in Latine *duodenum*, hath his name from the length of twelue fingers, which yet we finde it not to holde in our bodies; it may be, because now a dayes the stature of Mans body is much impaired. Galen calles it *ἐνδογαστρικόν*, as it were a production, to wit of the stomacke, which name yet some doe onely allow to the orifice of this first gut. This *duodenum* beginning on the right side, at the Pylorus [Table 6. figure 1, H] is reflected or turned backward, vnder the stomacke, that it may bee knit with membranous ligaments, to the spondelles or rack-bones of the loynes, to hold it straight and right downe; for if it should haue beene rowled and circled about, first the entrance of the Chylus should haue beene hindered, and then being gotten in, it would haue beene subiect to bee returned backe againe. Moreover, it would haue beene a hinderance to the veine that commeth from the Port or Gate of the Liuer, and to the Arterie which passeth to the Liuer: beside, indeede there is no space or scope for any such conuolutions or turnings in that place. It determineth vnder the Colon, about the beginning [Table 6, Figure 1, K] of his windings. It is the straightest of all the guts, that the Chylus should not suddenly and togetherward fall into it out of the stomacke; and some what thicker then the other two, because it receiueh a short veine from the trunke of the Port veine, which we called *intestinalis* [Table 3. I] or the Gut veine, (but no *mesentericall* veine at all) and an Arterie from the *Celiacall*; both which are led along according to the longitude of this Gut, to the beginning of the *Jejunum*. Vnder this the *Pancreas* or sweete bread lyeth, especially in Dogges, that it may boulder the vessels, and moysten or supple the gut with a slimie moysture.

The second small gut is called *ἰεῖον*, or the [Table 6. Figure 1, M] Empty gut: It is for the most part found empty, and that because of the innumerable *mesentericks*, and those very large, which ending in the inner coate of the gut, doe there gape with open mouth, and draw away the Chylus, as the nourishment fall lower and lower, till all the goodnesse bee drawne away. And if any part of the Chylus scape the first conuolution of this gut, yet the second or third will embrace it, till most of the profitable iuyce be drawne away by the *mesentericks* to this gut belonging; which suction or drawing is much increased by the vicinitie of the Liuer, and beside, the Aliment as it passeth by, being yet fluid, doeth easilie follow.

His beginning [Table 6. Figure 2. M] on the right side vnder the Colon, where the conuolution of the Gutes begin, is very liuid or blewe; when it commeth aboue the Nauill (whose whole region it taketh vp) being before wound vp into many circled labyrinths, it endeth into the *Ileon*. It is in length twelue palmes and three fingers. In breadth it exceedeth not the little finger, vnlesse it be puffed vp with winde. In the beginning of this *Jejunum*, or in the end [Table 6. Figure 1. I] of the *duodenum*, is the passage of Choller or Gall inserted, called *Porus Biliaris*; that after the Chylus is now fallen downe beneath it, the Liuer may vnburden it selfe by this vent of that humor, which by his *acrimonie* prouoketh the Guts both to expell the excrements containd in them, and to work downward the slimy phlegme that cleaueth vnto them; whence it is, that in dissections it is found more empty then the rest.

The third Gut is called *λεῖον* or *tenuis*, that is, slender, because of the tenuitie of his membranes; it is called also *εἰλόν* from a worde which signifieth to encompassse, as it were the circled gut; also *volutus*, because of his many circumuolutions, in which the meat maketh profitable stay and deliberation: this gut also giueth name to that fearefull disease called *Ileos*, or *Iliaca passio*. It is scituate vnder the Nauell, on both sides at the bones called *Ilea*, or hanch bones, and the cox or hip-bone: and though it be continuall with the *Jejunum*, and

Jejunum,
Duodenum.

His situation

The *duodenum*
receiueh no
mesentericall
veine.

Jejunum the
empty gut.

His place.

Length.
The passage
of the gal cal-
led *Porus Bi-*
liaris.
Why it is
found empty
according to
his name.

The *Ileon* his
names.

Iliaca passio,
miserere mei
Dei, a cruell
disease.
His situation

and of a like substance, yet heerein it differs, that we finde it not either so empty of *Chylus*, or so full of Veines. It beginneth where the gut groweth reddish, and the Meferaicke Veines grow smailer and fewer, and passing vnder the right Kidney, meeteth with the crasse and large or great gut, that [Tab.⁶. Fig.¹: O] buncheth out like a great Globe or Bowle, and endeth in his left side where it hath two holes; one continued with the *Ileon*, another lower, to which the blinde gut is ioyned. [Tab.⁶. Fig.¹: 3, 3, N] It is the longest of all the guts, euen one and twenty palmes long, and as broad as a finger is thicke, and because this gut onely can fall into the cod, this onely causeth the rupture cald *Hernia intestinalis*, the gut rupture, and so much of the small guts.

Hernia intestinalis.

The great guts.
The blind gut called *Cecum* *Intestinum*.

The great guts begin [Tab.⁶. Fig.¹: 3, 3, O] where on the right side they strut out like a great Bowle, where there hangeth downe an Appendix or additament, which is the first of the thicke guts, and is called *τυφλόν* or *Cecum*, that is, the blinde gut [Tab.⁶. Fig.¹: 3, 3, P] ha- uing that name from his obscure vse, others call it *Monoculus*, because it hath but one per- foration, yet some say it hath two in the same superficies, but diuided by so fine and thin a distance, that it seemes but one: when notwithstanding one of them is the end of the *I- leon*, [Tab.⁶. Fig.¹: 3, 3, N] and the other the beginning of the blinde gut, or of the Appendix. It taketh his beginning which is very thicke, from two heads; the end of the *Ileon*, [Tab.⁶. Fig.¹: 3, 3, N & O] and the beginning of the Colon: vnlesse we had rather say, that the vtmost part of the Colon ends into it, and that the *Ileon* is continued with it where it begins. In a man it is a slender long Appendix, and like vnto a great writhen worme [Tab.⁶. Fig.¹: 3, 3, 3, 1] or a little purse narrow toward the bottome, whence also it is called *Saccus*, farre nar- rower and streightier then any of the other guts; foure Finger long, and as broad as the thumbe, and is knit to the right Kidney by the mediation of the *Peritonaeum*, but hath no Mesentery tyed vnto it. In Dogges it is farre greater, and besides differs in the originall, for in them it taketh his beginning rather from the beginning of the Colon on the right side of it, then on the left.

What was the *Cecum* of the Ancients.

The vse of the blinde gut of the Ancients.

Of the Ap- pendix.

The Ancients did not call this Appendix of the Colon the blind gut (whence some of them haue deliuered, that in Beasts there are three thicke guts, in a man but two) but for it, did take that Globous [Tab.⁶. Fig.¹: at O] extuberation, which passeth from the insertion of the small guts vnto the Colon, of which we spake euen now. Wherefore *Galen* placeth the blinde gut on the right side of the *Ileon*, but the Colon he saith ariseth out of the left side, brought first vpward by the right *Ilea* or flankes. This blinde gut of the Ancients which we call the beginning of the Colon, in Apes, Dogges, Swine, & Oxen is very great, in whom it is a good helpe that in their groueling gate, when their fore-parts are violently moued, the excrements do not recoil to the small guts. The vse of this blind Gut, saith *Galen*, (vn- derstanding the beginning and bowled extuberation of the Colon) is to be as a belly wher- in the excrements are receiued, that if in the passage any thing haue escaped the distribu- ting vertue of the small guts, and the Meferiack Veines, it might by remayning sometime in this blinde gut be exhausted and sucked out. But the vse of the Appendix is whilst the Infant is in the wombe, to receiue those many and liquid excrements which in many mo- neths time are gathered together. After the childe comes to any growth in the world, the vse of this Appendix ceaseth, because (proportionably considered) there are fewer ex- crements gathered in the Collicke gut, and those that are, are dryer & thicker. Wherefore one saith verie wel, that the excrements growing fewer, are not driuen thereinto, and so it remayneth contracted and gathered together, not in length, (for the length, continueth the same) but in the Latitude, ouer it was in the Infant, euen as we saide before, it hapneth in the vmbilicall vessels.

The Colon or Collick Gut.

The situati- on of it.

The second thicke gut, [Tab.⁶. Fig.¹: 1. and 3. from O to 2. Tab.⁵ from 1 to O, Tab.⁷ EEEE] is more lax and loose, and is called *κόλον* of a word which signifieth to fore-flow, because by reason of his many blowne and swelling Chambers or Cels [Tab.⁶ Fig.²: 3, 3, Y] it forsloweth the passage of the excrements; or of a word which signifieth to wreth, or to rack, because of the racking Collick paine which in it is bred. The beginning of this gut, called by the Ancients the blinde gut [Tab.⁶ Figur.¹: 2. O] as is saide, is very large and more capacious then any other part of the gut is, and round like a Bowle or Globe, seated in the right *Ile- um* or flanke, [Tab.⁵ from 1 to K.] for there is a fit place empty for it, because the right kid- ney hangeth hie, to which it cleaueth: and touching the bladder of Gall vnder the Luer, yea sometimes being fastned vnto it, that it is dyed yellow by it, is turned vpward, rouled ouerthwart vnder the bottome of the stomacke [Tab.⁵ from K to L] and so passeth ouer the small

CHAP.
small guts.
per place,
lent prouid
which neith
determined
make an
made fit for
left side is
is passeth v
to the left K
thian bow.
Nephritic

Table vi. Den
The first fig
The second
Fundament.
The third
of the Colon
The fourth



small guts. And this is the reason why the Ancients haue written tha it occupyeth the vpper place, yet not in Dogges but in Men. And surely heerein Nature hath made an excellent prouision both for nourishment and concoction, because we eate many hard meates, which neither the stomacke nor the small guts are able sufficiently to put ouer, which are deteined in the Chambers of the Colon; and because this Colon passeth vnder the stomacke and the Liuer the fountaine of heate, these hard meates are there concocted and made fit for nourishment, and from hence are suckt away by the Meseraick veines. On the left side it is tyed to the Spleene [Tab. 5. G] with rare and thin Membranes; from the spleen it passeth vnto the share bone [Tab. 5. from L to M] and then is presently turned backward to the left Kidney, to which it is strongly bound, and so maketh a shew as it were of a Scythian bow. This strong binding of the Collicke gut to the left Kidney, is the cause why the Nephritick paine or fit of the stone in the Kidneys, is confounded with the collicke payne.

Table vi. sheweth the lesser and the greater guts.

The first figure sheweth the forme and folding passage of the lesser guts.

The second Figure sheweth the forme and convolutions of the greater guts, and the Muscles of the Fundament.

The thirde Figure sheweth together with the figure of the great gutties, the value or Membrane of the Colon or Collicke gut.

The fourth Figure sheweth a part of the collick and right guts, and the coates of the Guts.

TABVLA. VI.



H. 1. The *Pylorus* tied with a part of the Stomacke.

[K.] The gut cald *Duodenum*.

L.1. The pore or or hole of the choler cald
Porus Biliarius.

M 1. The beginning of the empty gut, cald
Intestinum leinum.

N. 1, 2, 3. The end of the lesser guts.

O 1,2,3. The beginning of the great guttes,
where is the blind gut of Galen and the An-
cients.

3. The value or membrane of the collick
gut, set to the sides of the Gut on eyther
hand, where his beginning is not made
round, but lax.

7. 1, 2, 3. The blinde gut of the later Anato-
mists.

RSTV. 1. The collick gut from *O* to *Q*, from the right kidney to the liver: from *Q* to *R* all along the bottome of the stomack: from *R*, to *S*, from the Spleene to the share bone: from *S* to *T*, the returne of the collick gut to the naell: from *T*, to *V* how it is led along again downward to the right gut.

3. The Collicke gut opened, that the value
may better appeare.

XX. 2, 3. The funke or flatted place of the Collicke gut.

1, 2, 3. The chambers or cels of the Collicke gut.

3. The beginning of the right gut.

2,3, The round Muscle of the right gut.

6, 2, 3, The two right Muscles of the right gut.

the place where the right gut is tied to
the yard in men & to the neck of the womb
in women.

4. The first and vtter coate.

f 4. The second coate of the guts.

4. The third coate of the guts which maketh their body.

b a. A part of the Mesentery, tying the right gut to the Holy or great bone.

L

But

The length
of the Collick
gut.

But to returne to the Collicke gut; at the left Kidney it is much narrower, lest it should compress the spleene; wherefore those men that haue swolne spleenes, doe not easily breake winde, vnlesse their spleenes be pressed; here also it hath no chambers: and againe arising more on the left side as it were vnto the seate of the Nauell [Table 6. Fig. 2. and 3. from S to T] maketh a double, (which double is the cause that in this place the Collicke torments are most grieuous, so that we haue seene heere apostemations [Table 5. M] matured or ripened through the skin, and after healed) and so being carried to the beginning of the *os sacrum*, in that very place where on the one side it arose from the right gut, it now on the other side [Tab. 5. N] endeth in it; but is distinguished from it by a certaine narrownesse, caused as it were by the whipping about [Table 6. Figure 2. from T to T] of a streight band: which place all Physitians in the administring of Clisters, and cure of the Collicke torments, must not forget. The length of this gut is about 7. palmes [demonstrated in the 6. Table and the 1. and 2. Figures] and so many fingers, and in breadth it is as wide as a mans Fist is thicke.

It is the largest and widest of all the Guts, that it might be a receptacle of the winds ingendered in the first concoction, to wit, in the stomacke and the small Guts; as also of the unprofitable and faeculent part of the *Chylus*, which remaineth about the end of the small Guts: lest (saith *Galen* in his fourth booke *de usu partium* and the 18 chapter) we should be constrained continually, or ouer often to empty our bodies, because within vs there is continuall segregation made of the excrements from the nourishment. Now this Gut being so capacious, those excrements may in great quantity be retained, and auoyded but at conuenient times.

The Celles also or chambers of this Gutte [Tab. 5. Q Q, Tab. 6. Fig. 2, 3, TT] make much for this purpose of Nature; and hence it is that some Birds whose guts haue no such Celles, doe continually mite, or very often: and therefore some haue called this collicke Gut, *The lower Belly*.

Lest therefore the excrements should forceably issue out, or perpetually prouoke the expulsive faculty, this Gut first of all ariseth vpwrd [Table 6. Fig. 2, and 3. from O to Q,] afterward bending downward, it is againe reflected vpwrd neere the end thereof [Tab. 6. Figure 2, and 3, from S to T] not vnlike to a *Romane S*. And hence it is that in our deiections, the excrements are not auoyded all at once, but as it were at two stooles, the second following the first, after a little distance of time.

And because it is very great, therefore it hath two strong ligaments; one, whereby it is fast tyed to the vpper parts, and by the other to the lower. It is also fastned to the backe by meanes of an externall membrane, springing out of the lower membrane of the Kall, as the other Guts are tyed to the backe by the interposition or helpe of the *Mesenterie*. But in Dogges it is no where tyed to the Kall, neither hath it any of these ligaments. If it were narrow as the small Guts, it would alwayes be distended, and so alwayes tortured.

Again, whereas the excrements when they passe out of the *Ileon* into the Collick gut, doe manifestly ascend [Tab. 6. Fig. 3, from N to O] lest in the compression of the belly (which is made by the muscles of the *Abdomen* and the helpe of the midriffe) to the sledge; the excrements and putrid or rotten vapours should not so easily finde the lower passage by the right gut, as returne out of the Colon into the *Ileon*, and so disturbe the distribution of the *Chylus*, and at length issue by the mouth, as it hapneth in that miserable disease called *Iliaca passio*, where the gut *Ileon* doubling into it selfe, maketh such a constipation of the belly, that the meate cannot descend, and so the remainders thereof being yet liquid in the small gut, and defiled with the noysome saueur of that place, are returned by vomit, and at last the excrements themselves, though not out of the great guts. But lest in euery notable compression of the belly this should happen, Nature hath ordained and scituated a certain valve, leaf-doore, or floud-gate, at the beginning [Tab. 6. Fig. 3, *] of this Colon where it is ioyned to the *Ileon*, which is membranous and thick, and looketh vpwrd, because the excrements of the meate are carried by ascent not by descent, out of the *Ileon* into the Colon, as is said before. This valve is easily found by the Anatomist, if you poure water into the right gut and hold it and the Colon vpwrd, for then you shall perceiue that none of the water, will passe into the *Ileon*, no nor winde, vnlesse you presse it very hard. You may finde it also when the guts are cleansed, but then it is somewhat vitiated by the transfusion of water, which you must necessarily vse in the cleansing of them.

The valves of
the Colon.

Lib. 5. method.
meden. cap. 48.

Hence it is that *Galen* sayth, the matter of clisters cannot naturally ascend into the *Ileon*

or

or small guts, although their medicinable force and vertue may goe a great deale higher. *Andreas Laurentius* hath described this valve in his Anatomie, where also he maketh mention of *Bauhines* description of it, and attributeth vnto it this vse especially of hindering the regurgitation of the excrements. But *Archangelus* sayeth, that at the blinde gut there are three valves like those in the heart, all appoynted for the same purpose, which the others before did agree vpon.

Lib. 13. metho.
medend. cap. 17

The substance of the Colon is more fleshy then that of the other guts, & beside it hath many Celles [Table 5. QQ, table 6. Figure 2, 3, Y] or chambered cavities, diuersly as it were arched; and againe linking into a narrower constraynt, wherein the hardest part of the meate may rest, and so receiue (for they lie vnder the stomacke and the Liuer [Table 5. at CC] a better concoction. But the small guts haue none of these Cels; the reason is, that the excrements of the Chylus should not be retained therein, the distribution of the same hindered, or the roome of the belly taken vp therewith. Finally, least the Cels or chambers of this Colon should bee dissolued or loosened foorth, there runneth through his middle and vpper part after his length, a certaine *vinculum* or band of the breadth of the middle finger: which being loosened or broken, those chambers are dissolued. When this Colon comes neare to the right gut, it becommeth round [table 6. Figure 2, 3, V] like the Colon in Dogges (that so the excrements and the winde also which issueth sometimes silently, sometimes with noyse, might bee more easily excluded) and so his end is narrow and straight, fit to ioine with the right gut.

The third of the great guts [Table 5, his beginning is at O vnder the bottom of the bladder, table 6. Figure 2, 3, Z, table 7, FG] is called *rectum*, of his right bore, and *dexter*, the beginner by *Hippocrates* in his first booke *Epidem.* because it hath his beginning where the boughts of the guts do end, and thence passeth from the top of the *sacrum* or holy bone, to the end of the rumpe, to which it is firmly tied by the interposition of [Table 6. Fig. 4. bb] the *Peritoneum*, least when it is burdened, it should fall with his owne waight: and so endeth in the seate, [Table 6. Fig. 2, 3, a] in men vnder [Table 6, vnder b] the bladder; in women vnder the wombe. In this place it is very great, which *Hippocrates* calleth *Partem laxam* or his loose part, and groweth to the yarde of men [Table 6, Figure 2, 3, d] sheweth the place] and to the necke of womens wombes, by the interposition of a musculous substance.

The last great
gut called *rectum*,
or the
right gut.

Hence comes in men that notable sympathy of this gut with the bladder, which maketh a man that is troubled with the stone in the bladder, to be euery moment prouoked to the stoole, but yet in women there is a greater sympathy betwene this gut and the wombe; so that oftentimes by compassion the gutte is vlceraed, and the excrements are auoyded by the secret parts. This gut could not be more commodiously placed; for the excrements being herein by degrees collected may be fitly together excluded. To the end of this gut a round muskle [Table 6. Figure 2, 3, a] is annexed, which may binde the orifice of it, whereupon it is called by *Hippocrates* & *Galen* *σφιγκτηρ*, that the excrements might not at all times but onely by voluntary compression and violence be euacuated. This gut is a palme and a halfe long [Table 6. Figure 2, 3, from z to a] and three fingers broad, and very corpulent or substantiall, and hath certaine fat appendixes or additaments growing to it without.

The great
sympathy be-
twene the
right gut and
the bladder.

The sphincter
muscle.

All these Guts as they are similar parts, do consist of a spermatieall substance and bloudy matter, changed into their proper flesh, if it may be so called: but as they are dissimilar they haue a membranous substance, that so they may without paine be distended or stretched, when they strut with the *Chylus*, with the excrements, or with winde; yet is not this membranous substance alike thicke, but the small guts haue it more slender, the great guts more crasse and thicke. This may bee shiuen into three coates; whereof one is common [Table 6. Figure 4, ee] to them all, as hauing his originall *mediately*, sayeth *Galen* 4. *usu partium* 17. from the *Peritoneum*: but immediately the *duodenum* and that part of the Colon that cleaueth to the stomacke, hath it from the lower membrane of the Kall, although it be not so in Dogs: and the *Ieiunum*, the *Ileon*, and the remainder beside of all the great Guts, haue their coate from the membranes of the *mesenterie*. For the membranes of the *mesenterie*, carrying the vesselles to the Guts, doe grow vnto them, where parting asunder, they feuerally walk along the sides of the Guts, & do degenerate into their third coat. This first common coat they haue as instead of a ligament, so also as a couering for their better defence. They haue beside two proper coats, [Tab. 6. Fig. 5. ff g] partly that their expelling power, saith *Galen*, might bee of greater force, partly also for security, when they abide

The 3 coates
of the guts.

4. vfu part. 17 many difficult affayes in diuers diseases, especially in the *Dysenteria* or bloody Flux, that the inmost beeing hurt, the other may remaine perfect for the performance of their duty. Wherefore, many haue beene knowne to superuiue when the inner coate hath beene eaten out: yet both these coats are thinner and softer then those of the stomacke, because this receyueth the meate when it is harder and vnconcocted, those when it is for the most part concocted and attenuated or made as thin as pulpe. The first [*Tab. 6. Fig. 4. ff*] or vter of these coates is membranous, but strong; for the most part furnished with tranuerse Fibres, sprinkled also with fleshy fibres, first to encrease his heate, that thereby the lesse laboured and digested parts of the Chylus may in their passage be more thoroughly concocted; and again, that like Muscles they might contract the guts to expel those final remainders which could not be auoyded by the compression of the *Abdomen*. Ouer this coate is drawne as it were a Veyle or Filme, thight but very fine, wouen for the most part of right Fibres. The other proper [*Tab. 6. Fig. 4. g*] coate is on the inside; in the small guts rugous or plightie, (in the Colon the plights are vnfolded and spread abroad into Cels) that it might moderately stay the Chylus as it falleth downward, thar if any part of it bee lesse laboured, it might receiue a farther degree of concoction in the passage.

The crust of the guts which is first lost in bloody fluxes.

Moreouer, that the same *Chylus* might the better bee sucked vp by the Veynes, these tranuerse foulds make this coate longer, and in some doubly and trebly longer then the vter coate: and for this cause also it was necessarily gathered into Plights; and these foulds or surphles are moueable, & may be driuen out of one place into another, (as the surphles of a hemme gathered vpon a threed) that they may retaine the *Chylus* moderately and without violence. This coate is also neruous, but yet it appears more fleshy, because of a crust like a Membrane which compasseth it about, engendred of the proper excrements of the guts arising from the third concoction, least the mouth of the Meseraicke Veins opening into this inner coate, should be stopped; and least the same inner coate, or the mouths of the Veines should be made callous or hard by the perpetuall passing of the *Chylus*. Both these proper coats at the end of the Colon and in the right gut are thicker and thighter or faster.

What fibres euerie coate hath.

They haue Fibres of all kindes, the inner oblique or slope Fibres, that they may reteine, the middle tranuerse or ouerthwart that they may expell, to the outward are added a few right Fibres, least the tranuerse should be separated asunder: wherefore without the gut they are tyed together with the right fibres as it were with a ligament, euen as Chirugions for the holding on of circular or round Ties, do cast ouer them right bands. But the right Fibres are fewer in the small guts, more in the great. In the Colon the Fibres follow his impressions or chambers. They are very great and large in the right gut, because of the many and hard excrements there heaped together.

4. The vessel of the guts.

The vessels of the guts (exhibited in the third *Table*) are Veines from the port veine, arteries from the Coeliacall [*Tab. 4*] and Mesentericall branches. For, to the *Duodenum* & the beginning of the *Ieiunum*, the gut-veine called *Intestinalis* runneth with a long course; but the rest of the *Ieiunum* and the *Ileon* and a part of the Colon, from the *Ileon* to the left kidney, haue Meseraicke [*Tab. 4. Fig. 2. 000*] veynes, which are carryed from aboue with an oblique passage through both the coars of the Mesentery, as it were out of his center. The vse of their veines, is to carry the Chylus from the guts to the Liuer, & bring back blood to them for their nourishment: the vse of their Arteries, is that they might be cherished with vitall blood, and by their perpetuall motion be preserved from corruption and putrefaction. *Galen* thought, that they tooke vp also a little of the meate in their passage. To the other and remaining part of the Colon and to the right gut, they are in a right line carried from the left Mesentericall Veine and the inferiour Mesentericall Artery.

4. vfu part. 17

They haue Nerues from the sixt paire, the *Duodenum* very small ones from those stomacke sinnewes which compass the *Pylorus* or lower mouth of the stomacke: the rest of the guts on both sides, receiue infinite surcles from a braunch which proceedeth from the roots of the ribs, from whence they haue most acute sense, that they might apprehend the prouocation of the chollier and the excrements; notwithstanding that a certaine mucous or slimy matter which lineth them within, makes their sensation somewhat more dull.

The vse of the fat and slime in the guts.

On the outside they are smeared, sometimes couered with fat, and on the inside lined with slime, and as it were nealed like earthen pots, that through their slipperinesse the excrements of the belly might sooner be precipitated or thrust downe (some thinke the Colon is lined within with fat) and least their exquisite sense should bee continually prouoked.

The

The common vse of the guts is to be in stead of earth or soyle to yeelde nourishment to the parts. For as in the earth is contained the aliment of the plants which they draw out by the Fibres or strings of the roots, so in the guts is the *Chylus*, which the rootes of the Meseraick veines do sucke out for the nourishment of the creature. Againe, the vse of the small guts is to be the Instrument of distributing the aliment; so saith *Galen* in his 4. Booke *de Vsu partium*, the 8. and the 18. chapters. For it behooued that there should be one Organ to concoct, and another to distribute; for otherwise the veines could not but haue drawn crude together with concocted and laboured nourishment. For the *Chylus* boyled in the stomacke was to be distributed to other parts, and the profitable parts thereof to be segregated & separated, which is accomplished by the Meseraicall veines. But because, as it hapneth in a Viall full of water, if it be turned vp the water cannot issue at the necke but by drops and degrees; so in the guts, if the veines had beene set to one place, the multitude of the *Chylus* would haue stopped his owne passage: therefore Nature hath well provided, that the guts should be drawn out into a great length, that so in each part of them a little quantity might be contained, & so a conuenient proportion suckt away by the mouths of the veines. Moreover, in the very passage of the *Chylus* along the guts, it receiueth a farther degree of concoction, as also doth the blood in all the veines. And therefore the substance of the guts is not much vnlike that of the stomack. But because they are not so neere the heate of the liuer as is the stomack, therefore nature hath assisted their cold membranous substance, by couering the with the warme happing of the *Omentum* or Kel, wherby their weak heat is cherished.

The common vse of the guts.

The vse of the small guts.

The vse of the great guts is to contain the thicke excrements and remainders of the meat together with the choler deriued vnto them from the liuer by the passage of gall, as also the winds that are daily gathered, which are stored in the chambers of the *Colon*, and the bredth of the other great guttes, and kept in by the Muscles of the fundament, as we shall more manifestly shew afterward.

The vse of the great Guts.

CHAP. VI. Of the Mesentery.

IT is called *Mesenterium* and *μεσεντερον* in Greek, because it is placed in the middle of the guts, which as we said before, are called *εσπερα*, for his feate is in the midst betwene the guts toward their backward position [Tab. 7. Fig. 1.] and incircleth them round. It is called also *μεσενταριον* from his peculiar substance. His figure is circular [Tab. 7. Fig. 1, 2.] and plaine, but gathered into folds; about the beginning it is narrow, in the middle ample and large, and in the sides (especially the left side where it descendeth to the right gut) it becommeth more long, for which causes *Galen* said, it was treble or three-fold.

The scituation cause of the name.

His Figure.

His beginning is at the first and third Spondell or racke bone of the Loynes from the *Peritoneum*, from whence are produced membranous Fibres which spend themselves in the two Membranes [Tab. 7. Fig. 2. TR] of the Mesenterie, hence it is that there is great consent betwene the Loynes and the guts; beside there passe also from thence certaine Nerues vnto the Mesentery. For it is compounded of Membranes, Nerues, Veines, Arteries, Glandules and Fat.

Originall.

It hath two Membranes [Tab. 7. Fig. 2. TR] one lying vpon another (in Dogges where it admitteth no vessels, they so grow together as if it were but of one simple Membrane, neither hath it any fat to make separation) and those firme and strong, as well for the strengthening of the vessels which are manifold and passe together vnto the guts, (to which vessels it serueth for a band and strong muniment) as also lest in violent motions the position of the guts should be altered or confounded, and that they might be stronglier tyed to the backe.

His Membranes.

The Meseraicke Veines [table 3. add table 7. Fig. 2.] diffused or spread abroad thorough these Membranes are innumerable and wondrous small, as it were the fine slender threds of the roots of a tree, which are still gathered into greater, till they growe all into one entire roote; so these vessels by little and little are knit together into greater, and those greater into others yet greater, till they are all vnited into one veine, which passeth vnto the Port, and resteth in the hollow side of the Liuer. Two Arteries called the vpper and lower *Mesentericall*, are sent vnto the guts, and make the Meseraicke Arteries, which also run through the Mesentery, that by their continuall motion they might ventilate and with

The scituation cause of the name.

The first Figure sheweth where the Mesentery beginneth or ariseth, his scite, connexion, and vessels; in it also the guts are remooved from the middle of the Belly, and are laide upward and downward vnto the sides, that the Mesentery might better appeare.

The second Figure sheweth the Mesentery taken and freed from the body.

TABVLA. VII.

FIG. I.



FIG. II.



AA BB. Parts of the Peritonaeum or rim of the belly, turned outward, and laide vpon the Ribs which are broken backward.

CCCC. The lesser Guts.

D. The blinde Gut.

EEEE. The Chollicke Gut, compassing round about the Lesser Guts.

F. The beginning of the right Gut.

G. The bladder.

*. The place where the Peritonaeum or rim groweth vnto the Bladder.

H. 1, 2. The Center of the Mesentery where the Peritonaeum tyeth the great Artery and the Hollow Veine to the racke-bones of the backe.

I. 1, 2. A glandulous body set for security vnder the distribution of the vessels which are inserted into the Center.

KK. 1, 2. Glandules set between the distributions of the vessels which passe to the Guts.

L MMM. 2 Do circumscribe that part of the Mesentery which tyeth the small Guts to the backe.

From N. to O. 1. A portion of the Mesentery which ioyneth the right part of the Colon to the backe.

From O. to P. 2. the Membrane of the lower kall, tying that part of the Colon that is knit to the stomacke, to the backe.

From P. to Q. 2. A part of the Mesentery knitting the left part of the Collicke Gut which runneth from the spleen to the right Gut.

From Q. to R. A part of the Mesentery tying the right guts to the backe.

S. 2. The two Membranes of the Mesenterie parted asunder with the nayles.

T. The first Membrane of the Mesenterie.

Y. The other Membrane of the Mesenterie.

Lib. 8. Admin.
Anat. ap. 6.

vitall spirite illustrate the Mesentery and guts, and so keepe them from corrupting; al which also are ioyned into one great one which lyeth vpon the backe. This Galen obserued sometimes to be presently parted in twaine out of one roote, sometimes to bee two seuerall distinct instantly from their beginning.

Nerves.

It hath Nerves also sprinkled diuersly as it were into many tendrils. Those are two, one on either side from the nerves which are reached from the six paire to the roots of the ribs: which Nerves being spread abroad after the fashion of a Membrane, doe inuest the branches of the Arteries, by which meanes the colde Nerves by the touch and society of the Arteries becomming warme, the Animall vertue proceeding from the Brain, is more freely communicated to the guts. It hath Nerves also from the sinewes proceeding from the Spondels of the loynes, and that for his better sense, that feeling those things that molest it, the expelling vertue being prouoked, it might turne them downe into the Guts. These Nerves together with the Veines and Arteries, are receiued into the center [tab. 7. Figure 1, 2. H] of the Mesentery, diffused through the whole body of it, and with an innumerable off-spring are carried through his coates or Membranes vnto the guts. It hath also glandules or kernels very [Tab. 7. Fig. 1, 2. KK] many (to which certaine thredy or hairy veines do come from the Meseraickes) interlaced with infinite diuarcations of the branches of the Port-veine, & the great Artery, with which they hold a certain proportion for their magnitude; but the biggest of them are about his center, where the first distribution of the vessels is made, and where they are most gathered together: as wel that they may support & diuide the vessels, as also that they may hinder their compression which would otherwise foreslow the

The Glandules
of the Mesen-
terry.

the distribution of the *Chylus*, like as they doe when they become *schirrus* [Tab. 7, Figure 1. 2, 11] or hard; whence followeth for this reason a generall consumption of the whole body.

Beside, it had not beene safe that so many vessels riding so high, being so slender and running so long course from their originall, should bee carried to the trunk of the port-veine without a kinde of conuoy: wherefore these glandules or kernels, as it were certaine wedges, are set between their diuisions, that in vehement motions they be not broken nor offende one against another. Finally they serue to moysten the guts, that their concoction may be celebrated by elixation or boyling, that is, by heate and moysture.

Amongst these glandules there is plenty of Fat, made of blood sweating or falling out of those vessels wee spake of euen now, and there retayned by the solidity of the membranes, with which fat the middle spaces are filled, and the heate of the parts cherished, that so the *Chylus* which is carried through them, is better prepared for sanguification.

And although this *Mesenterie* be one and continued together, yet in regard of his double originall, and of the guts which it tyeth together, and of the two Arteries; it may be diuided into that *Mesenterie* which knitteth together the small guts [Table 7. Fig. 2, L MM] in the middest of the belly called *μασάριον* and inio that which tyeth the colon [Tab. 7. Figure 2, from N to O] both on the right side and the left; [Tab. 7. Fig. 2, from P to Q] (not vnder the bottom of the stomach, for to that it is knit by the helpe of the *Omentum*) [Tab. 7. Fig. 2, from O to P] and in his lower part [Tab. 7. Fig. 2, from Q to R] groweth to the right Gut and is called by *Hippocrates* *μεσόκολον*. Lastly, it hath a part which they call the appendix [Tab. 7. Fig. 2, from Q to R] of the *Mesenterie*, being of the nature of a ligament, whereupon *Galen* diuideth it into the right, the left, and the middle *mesenterie*.

The vse of the *Mesenterie* is to tie the Guts together, as it were by a common ligament, and to fasten them to the Racke-bones of the Loynes, that they neither should bee confusedly shuffled together, or fall downe by reason of their waight. But the Colon or collick Gut in that part of it that runneth vnder the stomacke, is tyed to the backe by the Kell as hath beene sayde. Againe, the double membrane of this *mesenterie* doth inclose and sustaine the vessels which runne through it, that they should not be medled together, and so hinder one another, as also that they might more safely attaine vnto the Guttles, whereas happely if they were not strengthened by this duplication, they might break when a man did leape or fall, or otherwise straine his body there about.

The fat of the
Mesentery.

How *mesenteria*
differeth
from *mesocolon*

The vse of the
mesentery.

CHAP. VII.

Of the Pancreas or sweet-bread.

Pancreas, that is, all flesh, is so called because of the likenesse it hath with flesh in an ordinary and moderate body, for in a Fat body it seemeth to be Fat it selfe: it is also called *παλινκρεας*. It is an vnshapely body, very loose, all glandulous (wherefore *Archangelus* would haue it called *Pandenon*) and large. It hath his beginning at the first spondle of the loynes, and thence defused, spreads it selfe vnder the back-part of the stomach and his bottome, vnder the *duodenum* also [as appareth in the Table belonging to the chapter of the bladder of gall at the note 1] and the gate-veine at the Kidneyes, euen as farre as the seates of the Liuer and the spleene. In man it is not so red as in Dogges, and in all beasts because of their groueling gate, it lyeth vpon the stomacke.

That which in his middle appeareth white, is his *Parenchyma* or proper flesh, and because of his whitenes & softnesse, some call it *Lactes*: we call it the sweet-bread, because in Swine it is esteemed a sweete morsell, though the sweet bread of a Calfe or Veale bee another thing, as you shall heare hereafter. It hath veines but very small from the Gate-veines for his nourishment: and Arteries from the *Calicall* for his life; sinewes also from the sixt paire, & glandules. The especiall vse of it is to sustaine, secure & preferue from Compression the diuisions of the branches of the Gate-veine, of the *Calicall* Arterie, and of the nerues which are carried to the stomach, and to the Gut called *duodenum*; but especially, the Splenick braunch which passeth vnto the spleene: as also the vessell which containeth the choller called *Porus Biliaris*, because about his seate is the originall of all their diuisions.

Moreouer another vse it hath, by reason of the many glandules in it containd, which is to licke vp the remaynders of that muddy and superfluous Fat (or if you will, the crude

The sweet-
bread.

The situati-
on of it.

His vessels and
glandules.

His vse.

The vse of his
Glandules.

and

and phlegmaticke part of the blood, which *Hippocrates* calleth *hCanoſam humiditatem*, the muddy moyſture) which the Kall and Meſenterie could not contayne: that the blood being thus depured, might bee exhibited to the inward parts, more pure and better defecated.

Againe, whereas theſe glandules doe as it were feede vpon and deuoure the crude or raw and moyſt part of the blood; it muſt needs follow that from them ſhould exhale infinite vapours moyſt and hot, which ſteaming vp round about the ſtomacke, doe make this action of *Chyliſication*, a kinde of elixation or ſtewing, like a Maryes Bath.

nother vſe
of the pancreas

Finally, the *Pancreas* like a pillow or quiſhion is placed vnder the ſtomacke and other parts, leaſt being filled, they ſhould leane too hard vpon the ſpondelles of the loynes, and be violated with their hardneſſe. Albeit *Fallopius* and *Archangelus* I know doe reiect this vſe of it, becauſe there is no ſuch vſe of it in brute beaſtes, in whome it lyeth about the ſtomacke. It parteth alſo the ſtomacke from the great Arterie, leaſt when the ſtomacke is very full and ſtrutteth out, the Arterie ſhould be preſſed, and ſo the free courſe of the vitall ſpirits to the lower parts intercepted.

CHAP. VIII.

Of the branches of the Hollow Veine, & the great Arterie, diſſeminated through the lower Belly.

WEE ſhould now proceede vnto the ſtomacke, ſauing that wee thinke it not amiſſe before wee come vnto it, to giue you a ſhort view of the diuarcations of the hollow veine and the great artery, as they diuide and ſubdiuide themſelues in the lower belly: that if you pleaſe in the ſame body, you may call for a ſight of them before you trouble the carcaſſe too much, by remoouing the ſtomack and other entrals. And firſt of the branches of the Hollow veine.

The Hollow veine hath two trunke, one paſſeth vpward through the midriffe, the other downward, which we will diuide into the trunk and the branches. From the trunk [Table 8. K] moſt commonly there proceed on each ſide foure veines.

Adipoſa.

The firſt is called *Adipoſa*, or the veine of the Fat of the Kidneyes: the left of theſe, [tab. 8.g] is for the moſt part higher then the right [table 8.f.] They runne vnto the Fat of the Kidneyes and their vtter membrane. Sometimes one of them ariſeth from the Emulgent, as appeareth, [table 8.f.] ſometimes both.

Emulgent.

The ſecond is the Emulgent; the left of theſe [Tab. 8.c] which ſometimes ariſeth threefold, is higher then the right [Table 8.d] leaſt one of them ſhould hinder another in their ſuction; and longer alſo, becauſe the ſeminarie or ſeede veſſell ſpringeth out of it [Tab. 8.i.] Both of them when they attaine vnto the middeſt of the body of the Kidneyes are diuided and ſo implanted to carry vnto them the whey of the blood, which becauſe it ſhould not returne againe into the hollow veine, Nature hath placed certaine valves in the emulgents.

Spermarica.

The third is called *Spermarica* or the ſeede veine; the right of theſe [Table 8.b] is ſometimes double, ariſing out of the middle of the trunk below the Emulgent: The left ariſeth from the Emulgent [Tab. 8.i] becauſe otherwiſe it muſt haue rid ouer the Arterie, yet notwithstanding ſometimes it receiueth a ſmall branch from the *Caua* or hollow veine. They deſcend obliquely to the teſticles, and determine in the Bodden body called *Corpus varicoſum*, to which they carry the matter of the ſeede.

Lumbares.

The fourth are called *Lumbares* or the veines of the Loynes. Theſe are ſometimes two, ſometimes three on a ſide [Tab. 8.mmm] they paſſe between foure rack-bones of the loynes, and doe ſend two veines to the ſides of the marrow of the back which ariſe vnto the Braine, and haply they bring from the braine a part of the matter of the ſeede.

Rami Iliaci.

Afterward at the fourth ſpondell of the loynes, the trunk of the hollow veine [Table 8.n] is diuided into two branches which are called *Rami Iliaci*, out of which before their diuiſion there proceede on either ſide two veines.

Muſcula.

The firſt is called *Muſcula* [Table 8.np, np] one of which is higher then the other; ſometimes it proceedeth not from the branches, but from the trunk, and paſſeth to the muſcles of the loynes and of the *abdomen* or paunch, from whence it hath his name.

Sacra.

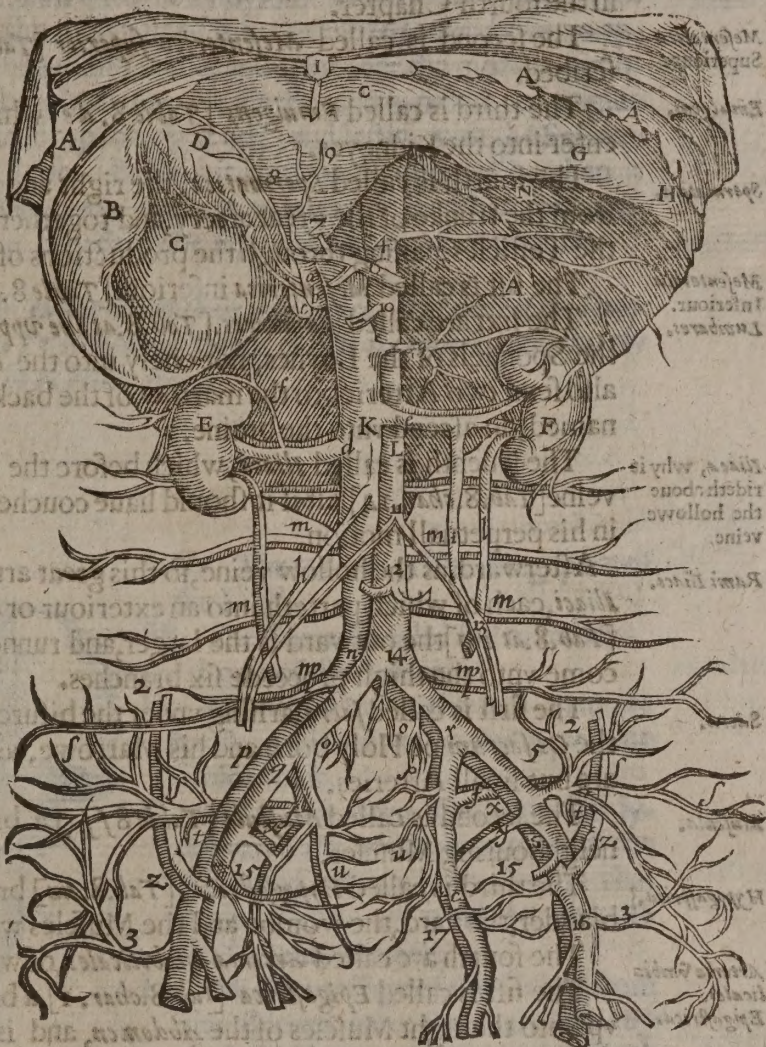
The ſecond is called *sacra*, a ſmall veine, ſometimes ſingle, ſometimes double, and paſſeth through the vppermoſt and formeſt holes of the *os ſacrum* or holy-bone [Table 8.oo] vnto his marrow, and hath his name from the bone.

Then

The branches of the Hollow veine and the Great Arterie, disseminated through the lower Belly.

TABVLA VIII.

- AAA The midriffe called *septum transversum*.
 BG The Gibbous part of the Liuer, the right side at B, the left at G.
 CC The hollow part of the Liuer called *Cava recora*.
 D The bladder of gall.
 EF The foreside of both the Kidneys.
 H The Ligament which tieth the Liuer to the midriffe.
 I The umbilicall or Naucl-veine where it is inserted into the Liuer.
 K The trunk of the hollow veine called *Vena cava*.
 L The trunk of the great arterie.
 N The gullet where it passeth through the midriffe or the bofome of the Liuer called *sinus hepatis*.
 a The trunk of the Gate-veine.
 b The Cysticke veines where they goe to the bladder of gall.
 c The passage of the bladder of gall which goeth to the gut called *duodenum*.
 de The emulgent veines with the emulgent arteries vnder them.
 f The right fatty veine called *adiposa dextra*, arising out of the emulgent.
 g The left fatty veine arising out of the trunk of the hollow veine.
 h The spermaticall veines, the right arising out of the hollow veine, the left out of the left emulgent.
 i The 2. vnters which carry the vrine vnto the bladder.
 m m m The veines and arteries of the Loynes called *Lumbares*.
 n n n Below, the vpper muscle veine and arterie, called *muscula superiores*.
 o The diuision of the hollow veine about the holy bone.
 p p The holy veines and arteries called *sacra*.
 q The Iliacal branch of the hollow veine.
 r The Iliacal arterie.
 s The diuision of the Iliacal arterie, and the Iliacal veine vnder it, into the inward and the outward; the inward is marked with p, the outward with s.
 t The interior transverse or crosse branch.
 u u u The middle muscle veine.
 v v The veine and arterie of the yarde, proceeding from the branch marked with p, and s.
 w w The Hypogastricke veine which sendeth branches from the inner bough to the bladder, the wombe, and almost all the parts in the water-course.
 x x The place where the umbilicall arteries are inserted.
 y A portion of the externall branch, wherewith the internall is augmented, Character. The remainder of the inward branch. z, z The Epigastricke veine which is a propagation of the vtter bough: it creepeth vpward by the lower parts of the Abdomen to the Nauell. 2 The lower muscle veine, reaching to the Coxendix or Hips: a veine without an arterie, which derieth his branches to the muscle of the fundament, and to the skin about them. 4 The great arterie piercing the midriffe. 5 The arterie of the midriffe called *Arteria phrenica*. 6 The Celiacal arterie. 7, 9 An arterie passing to the Liuer. 8 The Cysticke arterie, or arterie of the bladder or gall. 10 The vpper mesentericall arterie. 11 The originall of the spermaticall arteries. 12 The lower mesentericall arterie. 13 The coniunction of the spermaticall veine and arterie. 14 The diuision of the great arterie into the Iliacal branches, and how it ascendeth about the hollow veine. 15 The arterie of the priuities called *arteria pudenda*, which is a shoot of the inmost branch, going to the parts of generation. 16, 17 The remainder of both the trunks marked with p, and s, running to the thighs.



Then the Iliacal branch is on both sides bifurcated or forked [Tab. 8. vnder r] into an exterior or vter [tab. 8. vnder q] and an interior or inner. From these proceed three veines.

The first is called Epigastrica [Tab. 8. vnder character 1,] which is disseminated into the Peritoneum and the muscles of the abdomen. The chiefe branch of this veine ariseth vnder the right muscles of the Abdomen, euen vnto the veine called Mammeria, and with it about the Nauell is ioyned by Anastomosis or inoculation.

The second is called Hypogastrica, a notable veine [Tab. 8. uu] and sometimes double. It is disseminated almost into all parts of the Hypogastrium or water-course, the bladder the yarde and the wombe; and at the right gut maketh the externall Hemorrhoidall veines.

The third is called Pudenda [tab. 8. character 15 15] which is consumed into the scrotum & the flesh of the yarde or virile member.

These veines being thus deriued out of the Iliacal branches of the hollow veine, they passe on either side out of the lower belly [tab. 8. s t] and are called Crurales, or the veins of the thighs, of which we shall speake hereafter. And thus much of the branches of the Hollow veine, now followeth the great Arterie.

The Great Arterie also hath two Trunkes, the lesser goeth vpward, the greater [Tab. 8. character 4] descendeth, because it hath more parts to bee communicated vnto. This trunk

The bifurcation of the Iliacal veines. Epigastrica.

Hypogastrica.

Pudenda.

Crurales.

The greater trunk of the great Arterie.

accompanies the Hollow Veine (for the Veines and Arteries are sorted together quite through the body) and sendeth forth branches almost like vnto it, of which wee will now entreate.

Celiaca. The first is called *Celiaca* [Tab. 8. char. 6.] a notable artery of which we haue spoken before in the fourth Chapter.

Mesenterica Superiour. The second is called *Mesenterica superior* [Table 8. character 10] before Chapter 4. described.

Emulgens. The third is called *Emulgens* [Table 8. de] which together with the Emulgent Veines enter into the Kidneyes.

Spermatice. The fourth is called *Spermatice*, the right and the left [Tab. 8. char. 11] both of them arise from the trunk of the great artery, and together with the Spermaticall veines attaine vnto the Testicles, passing through the productions of the *Peritoneum* or rim of the belly.

Mesenterica Inferiour. The fift is called *Mesenterica inferior* [Table 8. char. 12] described in the 4. chapter.

Lumbares. The sixt are called *Lumbares*. [Tab. 8. at the upper mmm] They passe through the holes of the Spondels of the Loynes, not onely into the *Peritoneum* and the Muscles confining, but also send two Arteries to the marrow of the backe, which together with the veines aboue named, do ascend vnto the braine.

Iliaca, why it rideth aboue the hollowe veine. The seuenth is called *Iliaca*, which before the Artery is diuided, rideth ouer the hollow veine [Tab. 8. char. 14] lest if it should haue couched vpon the bone, it might haue beene hurt in his perpetuall motion.

Rami Iliaci. Afterward, as the hollow veine, so this great artery is diuided into two trunks, called *Rami Iliaci*, each of which parteth into an exteriour or outward, & an interiour or inward branch; [Tab. 8. at r q] the outward is the larger, and runneth into the thigh. From these before they come vnto the thigh proceede six branches.

Sacra. The first is called *sacra*, arising vnder the bifurcation or forking, [Tab. 8. o o] and passeth to the *Os sacrum* or Holy bone and his Marrowe, as the veines did called before *Sacra*. These are but small Arteries.

Muscula. The second is called *Muscula* [Table 8 ff] a branch of the vtter bough running vnto the neighbouring Muscles.

Hypogastrica. The third is called *Hypogastrica*, [Tab. 8. uu] branches of the inner bough passing vnto the bladder, the yarde, the wombe and the Muscles which couer the share bone.

Arteria Umbilicales. The fourth are called *Arteria umbilicales*, of which we haue spoke abundantly before.

Epigastrica. The fift is called *Epigastrica* [tab. 8. char. 1] a branch of the inner bough, which climbeth vp vnto the right Muscles of the *Abdomen*, and is ioyned with the *Mammaria*, as is saide of the Veines.

Pudenda. The sixt and last is called *Pudenda* [tab. 8 char. 15] a branch of the vtter bough, which is consumed in the skin of the virile member. That which remaineth of the great Arterie, passeth into the Thigh, and is called *Cruralis* of which wee shall entreate afterward: now we will returne vnto the Entrals or Bowels, from which we haue a little digressed, to shew you the diuications of these vessels in the Lower belly, but that very breesely, because we reserue their more exact description to their proper place in the Booke of the Veines and Arteries.

CHAP. IX.

Of the Stomacke.

The stomacks names.

THe Ventricle as it were a little Venter, is called in Greeke *nomia*, that is, a cauity or hollownesse, of a word that signifieth hollow or *concauous*, and *γαστήρ*, which is indeed the proper Greek word for it. It is the comon receptacle of meate & drink, the Kitchen of the body. It is but one in men & other creaturs that haue both iaws set with Teeth, but in those that chew the cud, which haue but one iaw of teeth, it is four-fold: in birds it is three fold. It was necessarily to be placed where his extention might not be hindered, yet as neere the mouth as might be for the receiuing of the meat to be coqued for the whol body. Wherefore for that there was no roome in the chest or neere the mouth, it being taken vp by the parts which serue for respiration, & encompassed beside with a wal of bone, which would haue hindred his dilatation, it is seated lower, [tab. 9. FF] immediatly vnder the

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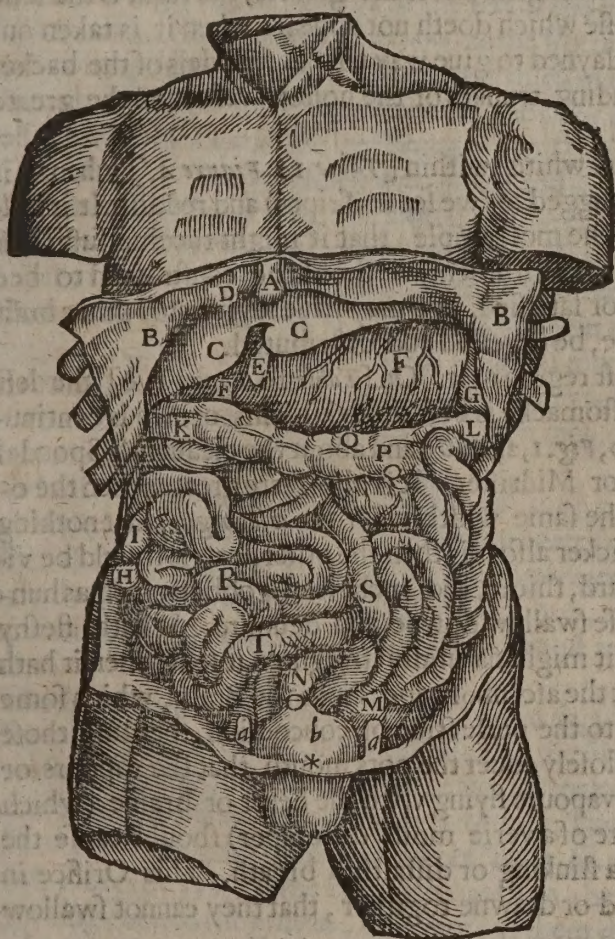


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the *Diaphragma*: betweene the Liuer and the Spleene, [table 9. CC. sheweth the Liuer, G. the Spleene, and FF the stomacke] in the middest of the body, saith *Galen 4. vñ partium 7.* especially his vpper orifice, ouerthwart between the two *Hypochondria*, that it might be continued with the guts, not so much for the distribution of the *Chylus*, as that the Excrements might be more easily setled lower, least with their noysome vapours they should molest the heart and the Brain. It lyeth for the most part of it in the left *Hypochondrium*, as appeareth in the 9 Table, because heere it had most roome, and againe for the more commodious implantation of the vpper mouth, by which it receiue the meate; moreover, to giue way vnto the [table 9, CC] Liuer which takes vp the right side; and lastly, with the Spleene to helpe to ballance the body against the Liuer. Before, it lyeth bare, especiallie when it strutteth, not vnproperly then called *ἀποζωογασίς venter fermentatus*; (for when it is empty, it is more hid vnder the Liuer) that it may easily be felt with the hand; wherefore.

Tab. 9. sheweth the Bowels of the Lower belly, euerie one in their owne place. The ends of the lower Ribs, together with the Midriffe and the Peritonaeum adhering thereto are turned back, that the Liuer, the Spleene, and the stomacke might be better scene.

TABVLA. IX.



CC. The *Gibbous* or bunching part of the Liuer.

FF. The stomacke filled full of meate.

G. A part of the Spleene.

H. The blinde gut of the late writers: for the ancients tooke the top of the Colon for it.

K. to L. the same Collicke Gut lyeth vnder the whole bottome of the stomacke, which is the reason that those which are troubled with the Collicke cast so much.

L. to M. The passage of the Colon, from the spleene vnto the share bone by the left kidney a-way, which maketh the payne of the Stone and the Collicke on the lefte side, very harde to distinguish.

P. The sunken or fallen side of the Colon at P. and his Chambers and pusses at Q.

it is quickly affected with cold, and therefore care must be taken of it. On the right side, the vpper and forepart of it lyeth vnder the hollownesse [table 9. F vnder C] of the Liuer, & by it is embraced, whereby his heate is cherished. On the left side his greatest part reacheth to the *Diaphragma*, whereupon when it is too much stuffed, by hindering the motion of the *Diaphragma*, it causeth the disease calleth *Dyspnœa*: likewise the Spleene, [table 9 G] lieth vnder his left side against the backe and lower part thereof. Behind it are, the backbone as a strong and thicke defence, and the Muscles of the Loynes as a soft bed with fat growing thereto for his better repose, which also doe adde warmth vnto it. Below, it confineth vpon the guts and the *Omentum* or Kall, and vnder his bottome lyeth the Colon [table 9. KL] with the *Omentum* betweene them, whence commeth their mutuall consent and sympathy not onely in the Collicke paine, but also after the taking of a Medicine there followeth a kinde of loathing and vomiting, the excrements going this way to the *Rectum* or streight gut.

His

- His magnitude** His magnitude is diuers, *Hippocrates* counts it five palmes bigge. Taken out and blown it is much greater then it can be whilst it is in the body; notwithstanding, whether it containe more or lesse, yet it so closely embraceth that it receyue for the better concocting and boyling of it, that it leaueth no emptinesse in his whole cavity.
- The connectio.** But least being filled it should fall downe with the waight, his left orifice which is continued with the [Table 10. Figure 1, 2. G] *oesophagus* or Gullet, is tyed to the *Diaphragma*, the right is ioyned [Tab. 10. Fig. 1, 2. H with P] to the *Duodenum*. On his backe and vpper part, he lyeth vpon the backe bone, and cleaueth to the fift spondell of the Loynes; below to the *Omentum*, other where it is loose and free, that it might more freely be distended. Finally, vnder his bottome, and especially vnder his lower mouth called *Pylorus* [Ta. 10 Fig. 2. HP] and vnder the beginning of the *duodenum* is the *Pancreas* placed [Table 10. Figure 2. S] to bolster them vp. His figure [Table 10.] is round for the more capacity, and that it might be lesse subiect to be offended. Long it is because of his two orifices, which make it very like vnto a Bag-pipe. On the left side, and in the bottome [Table 10. Figure 2. M] it is larger and rounder, but toward the right hand it is by little and little attenuated or lessened, that it might giue place to the Liuer, and that the meate might by degrees fall from that side toward the bottome, which is the chiefe place of concoction. Foreward it is [Table 10. Figure 1. LL] equally bunched; backward [Table 10. Figure 2. MNO] whilst it is yet in the body it hath two protuberations or bunches, the left is the greater, the right is the lesse and flatter, betwixt which is a hollownesse which doeth not appeare when it is taken out and blowne: which hollownesse was ordayned to giue way to the spondels of the backe, [Table 10. Figure 2, O] and to the descending trunks of the hollow veine and the greate Arterie.
- His Cautie.** On the outside it is smooth, plaine and white: within [Table 10 Figure 4.] when it is knit or gathered together, it is rugous or rugged (as we see in Tripes) and reddish. It is hollow, and his hollownesse of all other parts the most ample, that it might receiue sufficient quantity of meate and drinke, least for our nourishment we should be constrained to bee alwayes eating; now, when it is once full or satisfied, wee may haue leysure for other businesse, whilst all the meate taken at a meale, be digested and distributed.
- His Orifices.** There are two Orifices in the vppermost region of it. On [Table 10. Figure 1. L] the left side one which appeareth best when the stomacke is best stuffed. This orifice is continued with the *oesophagus* or Gullet, [table 10, Fig. 1, 2, ABC] and about the eleauenth Spondel of the breast, is knit vnto the *Diaphragma* or Midriffe. It is also farre greater then the other, [table 10. Fig. 4. l in respect of m] of the same width with the *oesophagus*, that nothing which we can swallow might stay at it. Thicker also it is then the other, least it should be violated when it is constrained to receyue hard, thicke, and vnchewed gobbets, such as hunger bitten folke do with great raueness swallow downe and deuoure. It hath fleshy and circular Fibres [table 10. Fig. 4. l] that it might naturally streighten it selfe when it hath receiued the meate and drink, to intercept the ascent of vapors into the Brain, which some also would haue to giue great furtherance to the perfection of concoction, because those that would sodainly boyle any thing, do closely couer the pots mouth, that the vapours or fumes might be kept in. Againe, least the vapours flying vp to the heart or braine (which happeneth to great eaters, and those that are of a verie moist distemper) should cause the Giddinesse, the Meigram, suffusion, and a stinking or distastfull breath. This Orifice in some vpon extreame greefe is so contracted or drawne together, that they cannot swallow any whole meate.
- The vpper and left Orifice.** Finally, these Fibres serue to this good purpose, that those things which we eate, should not returne into the *oesophagus* or mouth when a man stoopeth low forward, or lieth much backward.
- A pretty note why in great griefe meat will not downe** This Orifice because of the abundance of sinnewes [tab. 10 Fig. 1, 2. TVE Fig. 2 XY] that it receyue, is of most exquisite sence, that it might feele it owne want; which sence of want stirreth vp the appetite, that the creature might addresse himselfe to provide for more meate and drinke to satisfie it. The Auncients call this Orifice *καρδία*, that is, the heart, because when it is affected, by reason of his exquisite sence, the like symptoms or accidents follow which follow them whose very hearts are affected, whence the paine of this mouth of the stomacke is called *Cardialgia*, we call it heart-burning, when indeed it is only a disease of the mouth of the stomacke. Sometimes the like soundings do follow as when the heart is affected; and to say truth, the heart is alwayes with it drawn into consent, not
- The seat of appetite.**
- καρδία or the heart-burning.**

so much because of the neere neighbourhood that is betweene them, as because their fi-
newes proceede from the same branch. Some call it the mouth of the stomach, common-
ly the vpper orifice; sometimes it is called the stomach, because of his largenesse; and be-
cause it commeth nearer to the back-bone then to the brest blade, therefore wee applie in
his diseases, locall medicines both behinde and before; before is more vsuall, but when
the stomacke laboureth, then we apply not onely before.

The neather and the right orifice [tab. 10. fig. 1. 2. H] of the stomache, is also bent a little
vpward, being the bredth as it were of foure fingers distant from the bottome, least the
weight of the meate should open it. This within, beside transuerse Fibres, is compassed
with a thicke and compacted circle, after the fashion of a round Muscle, or like the Sphin-
cter or Muscle of the sledge (which sometime becommeth *schirrhus* or hard) by which
after a naturall instinct, it may be shut and opened, streightned or widened. This remay-
neth fast locked till the meate bee perfectly changed and boyled into a moist and liquid
Creame, wherefore also it is narrower [tab. x. fig. 4. compare with m] then the left ori-
fice, yet it may be opened as wide, as do testifie the stones of fruite being eaten, Bullets of
Lead swallowed, and other things by chance gotten downe, which without annoyance
are againe rendred at the sledge. This afterward beeing by degrees relaxed and opened,
doth by his strength, not being prouoked by weight, driue down the Chylus into the *duo-*
denum [tab. x. fig. 1. 2. P] and so to the rest of the guttes, to bee sucked by the Meseraicke
Veines; wherefore it is called *πυλωρος*, or the Potter, commonly the neather orifice. In a
word, where on the left side the stomach is thick in his top, there his vpper mouth begineth
from the *oesophagus* or Gullet; where on the right side it is thicke and eleuatad, there is the
end of the stomach, and the beginning of the *Duodenum*.

But because when it is filled with meate and drinke, it might bee commodiously disten-
ded, and the vyands being distributed againe constringed and streightned, and in great
Meales when it is thrust full not be violated: For these reasons I say, the substance of it is
Membranous and Neruous, which when the stomache is corrugated or crumpled vp, is
thicke; when it is dilated it is thin. And verily in those that are much giuen to their pan-
ches, it is so enlarged and rarified that it can no more be corrugated, which oftentimes is
a cause of long weaknesse of the stomache; after such gourmandizing fits; for in whome,
soeuer the body of the stomache is thin, such men do worse concoct their meat, then they
that haue it fleshy and thicke.

It hath three Membranes or coates [tab. x. fig. 3] one common and two proper. The
first which is the vtmost and the common coate [tab. x. fig. 3. h h h] from the *peritoneum*;
yssue thence where it compasseth the *Diaphragma* at the vpper mouth: this addeth
strength to the proper coats. It hath right Fibres, and is the thickest of all the coats which
come from the *peritoneum*, because from it must arise the vpper Membrane of the *Omen-*
tum.

The second coate is altogether fleshy [tab. x. fig. 3. i] consisting of fleshy Fibres, which
being contracted, whatsoeuer is offensive to the stomache, is as it were wittingly vomited
vp; those Fibres also increasing the heate, do make much for the helping of concoction;
because for that office a great heate is required. This is immediately knit vnto that which
followeth: it hath also transuerse Fibres [tab. x. fig. 3. j] vnder which a few fleshy oblique
or side Fibres do lye. Some of which run from the vpper mouth, where they haue their
beginning euen to the *pylorus*, but more of them do descend to the bottome of the sto-
mack toward the *pylorus*. Vnder these about the left mouth, do arise circular fleshy Fibres
which do shut the orifice: but when the transuerse and oblique do moderately drawe the
stomacke together, it embraceth the meate; if violently or strongly, they driue the meate
now digested by degrees toward the *Pylosus*, because it looketh vpward, and the Chylus is
beaue.

The third coate is inmost and Neruous [table x. figure 3. k] into which the vessells them-
selues are ended: this is continued to the coate of the *oesophagus*, and of all the particles
which are in the mouth; because the mouth should admit of nothing that might be vnplea-
sant or distastfull to the stomache; and because the preparation to the first concoction is
made in the mouth. Hence it commeth, that when any chollericke humour or vapour is
raised vp, the tongue is defiled with bitternesse and yellownesse, and oftentimes the ex-
ulcerations of the mouth and the tongue are communicated to the *oesophagus*, and the sto-
macke, and theyrs againe to them: by reason of which consent, we cannot euacuate the

The neather
and right ori-
fice called *Py-*
lorus.

The voluntary
worke of the
Pylosus.

The substance
of the stomach

The Mem-
branes of the
stomacke.
The common
Membrane.

The 2. Coate.

The 3. Coate.

The fibres of
the third coate

head by the Palate, but we must also euacuate or empty the stomacke.

The use of
the Fibres.

His third coat is wouen with three kinds of Fibres, that so the stomacke might bee the better extended. The right Fibres are very many and conspicuous aboue the rest, by which as it were by hands, they say it snatcheth his meate; by the oblique which are outwarde, it reteyneth it; and by the transuerse it expelleth it after it is labored and concocted. Al these are so thightly wouen one within another, that they will not appeare vnlesse they be distracted and rent or sluen asunder. This coate is also rugous and vnequall. In those beasts that chew the cud, harsh beside and rough, and distinguished into certaine proportionable inequalities, nor vnlike to the hony-combe.

It hath these foulds and roughnesse from a fleshy crust which ariseth out of the excrements of the third concoction of the stomacke, and serueth to defend it from any harde thing that should be receyued into it, least if it selfe were made callous, the mouths of the Veynes should be stopped, that neyther the Chylus could be sucked out of the stomacke, nor the stomacke be able to draw blood for his nourishment. It maketh also somewhat for the moderate retention of the meate; for by his corrugation and harshnes, it holdeth

Table x. sheweth the stomacke with the Gullet.

The first Figure the foreside of them both, with the vessels inserted into them. The second figure their backe sides. The third Figure sheweth the Coats and Fibres of the stomacke. The fourth figure sheweth the stomacke with the inside turned outward.

TABVLA X.



ddd 1, 2. The fourth veine cald *Coronaria stomachica*, with his artery, compassing the left mouth of the stomack. This is a branch of *Gastrica maior*. e 1. Certain branches from the branch marked with a descending from the top of the stomach, and running with their Artery toward the *Pylorus*. f 1, 2. The first veine cald *Gastrica maior*, deriued from the Splenick branch; which together with his arterie and nerues creepeth to the left side of the bottome of the stomacke. g 1, 2. Vessels deriued from those which passe to the spleene. h h h 3. The first and outmost coate of the stomacke from the *Periconaeum*. i 3. The second coate. k 2. The first and inmost parted in this place from the two other. l 4. A round swelling of the left orifice bending inward, where the Gullet is continued with the stomacke. m 4. A round swelling of the right orifice of the circle of the *Pylorus*. n 4. The inward superficies or surface of the stomacke.

A 1, 2. The Orifice of the Gullet cut from the throat.
B 1. The straight and direct course of the gullet from A to B.
C 1, 2. How the Gullet about the first rack bone of the chest from B to C, inclineth vnto the right hand in the first figure, and to the left in the second.
D 1, 2. His inclination to the left hande from C to D in the first Figure: but in the second to the right hand.
EE 1, 2. The two Glandules cald *Tonsillae*, or the Almonds set close to the gullet in the very end of the throat.
F 1, 2. Another glandulous body in the midst of the gullet about the 5. rackbone, but it lyeth vnder it. In calues we call this the sweet bread.
G 1, 2. The connexion of the gullet with the stomacke where the vpper orifice of the stomacke is fashioned.
H 1, 2. The 2. orifice of the stomack, cald *Pylorus*.
I K 1, 2. The vpper part of the stomacke at I, the lower K.
L L 1. The foreside of the stomacke.
M N O 2. The backside of the stomacke, and M sheweth the prominence of the left side, N of the right, but O sheweth the docke or impression, where it resteth vpon the racke-bones.
P 1, 2. The gut cald *Duodenum*.
Q R 2. The passage of the bladder of Gall into the *Duodenum* at R.
S 2. A Glandulous body groweth vnto the *Duodenum*, bearing vp his vessils.
T V 1, 2. The right and the left Nerues of the first paire, encompassing about the gullet and the vppermost or left orifice of the stomacke.
X Y 2. A Nerue on the left side creeping vp to the top of the stomacke, and so running out to the Liner.
a 2. The first Veine of the stomacke, cald *Gastrica dextra*, or the right stomack vein coming from the trunk of the gate veine, and his Artery cometh from the trunk of the *Celiacall* Artery, both of them reach vnto the *Pylorus*.
b 1, 2. The second veine cald *Gastrica sinistra*, together with the Artery accompanying it, and a Nerue, all tending to the right side of the bottome of the stomacke.
c 2. The third Veine of the stomacke cald *Gastrica minor*, it wanteth an Artery for his companion from the splenick branch.

that

that which is raw or vndigested that it cannot fall out of it. This Crust is spongie, having small holes as it were short Fibres from the inward to the outward superficies, thar by these hollowe passages of his, the thinner part of the Chylus might pierce and be sucked away by the veines. This crust may be separated from the Membrane or coate in brute Beasts, yea also in the stomacke of a man if it be perboyled.

The crust of the stomacke.

The stomacke is not thicker or fleshier in the bottom then in other parts, nor as it is at either of the mouthes. Some say that in corpulent men there cleaveth a Fat to the bottom, on the left side; which when it is plentifull, they say a man may endure long before hee shall have any appetite to his meate.

The vesselles the stomacke hath are these. Sixe veines branched from the gate-veine, some of which come from his trunk, others from the mesentericall or spleenical boughes. From the trunk commeth the right *Gastricke* [table 10. figure 2. a.] which goeth to the right orifice; and the right *Gastra epiplois* [table 10. figure 1. 2. b.] from the mesentericall bowe attaineth to the middle of his bottome. From the spleene bow the lesser *Gastricke* [table 10. figure 2. c.] which goeth to his back-part; the greater [table 10. figure 1. 2. f.] *Gastricke*, from which comes the crowne veine of the stomacke, which in [table 10. figure 1. 2. d d d] mannee of a crowne incompasseth his left orifice or vpper mouth: the left *Gastroepiplois* disseminated into the other middle part of his bottome. And finally, that we call *vas breue* or the short vessell [table 10. figure 1. 2. g.] of all which we have intreated more particularly in the chapter of the gate or port veine.

The vessells of the stomacke Veines.

The office of these veines is to bring in blood for nourishment, for it is nourished continually as it was in the mothers wombe, that is, with blood not with Chylus, by which we grant it is delighted and refreshed, but cannot grant that it is nourished with it. Some few of these also while the Chylus is boyling in the stomach, do insensibly sucke out some small part of it (for they are but few in respect of those which determine into the Guts, because in the stomacke is celebrated concoction, but the Guts containe the Chylus already concocted, which it was fit should be with all expedition distributed) and do change it into blood by a naturall instinct, before it come to the Liuer, as *Galen* teacheth; haply that the membranes of the stomacke may with it be nourished. Or if thou hadst rather, say that these veines do carry the Chylus, that haue sucked after the manner of the *Meseraikes*, to the rootes of the port veine, that are disseminated through the Liuer, that there it may be turned into blood. From these veines come those sodaine refectiōs of the spirits by sweet and strong Wine, Broths, & Cordials; which refectiōs would not so soone follow, vnlesse the Liuer did suck nourishment by them out of the stomacke. That which is called the *vas breue* or short veine, which from the veines of the spleene is by an vnited passage of many branches carried into his bottome, doeth there belch out a sowe and shape juyce, sometimes to the vpper mouth to stirre vp appetite, (which yet properly is prouoked by sence of want) and to strengthen it by his adstringent vertue.

Their office

Gal. 4. v. 2. p. 12.

A good note of the sudden refectiōs which come from wine & cordiall potions.

It hath Arteries, from the Coeliacall branch of the *Aorta* [table 10. fig. 1. 2. ABDF] or great Artery, which doe accompany euery one of the veines, excepting the lesse *Gastricke* [table 10. figure 2. c.] to afford strength of life to preserue it from putrifaction, by ventilation to cherish, refresh and increase his naturall heate with their heat and vitall spirit, that so concoction might be made more perfect: but of these branches more hath beene sayd in the chapter of the Coeliacall Arteries.

The Arteries of the stomacke.

It hath very conspicuous and notable nerues from the sixth paire, which at his orificies or mouthes are double; [table 10. fig. 1. 2. T. V.] disseminated from those branches which make the recurrent nerues, and yeilde certaine Tendrilles to the lungs and the pericardium, or purse of the heart; which Tendrills because of their softnesse and the length of their way, are couered ouer with strong membranes, and do run crosse one another; that for greater security they might passe obliquely or aside-long; and piercing through the diaphragma or midriffe are on both sides doubly diuided: so that the left compasseth the [table 10. figure 1. 2. TVKZ] right and backe part of the mouth of the stomacke, and the right and left and forepart; which orifice they doe so inuolue, that it seemeth to bee made altogether of sinewes; from the abouandance of which, it hath most exquisite sence to stirre vp and awake the sence of the want of nourishment, which sence ariseth from suction; for there is the seat of the appetite; & to this onely part hath nature giuen the sence of want or of Animal hunger; so that we feele that part especially to be contracted when wee are extremely hungry. For if we should not feele a kinde of molestiō vpon the viters and absolute exsueti-

The nerues.

The cause of hunger.

The seat of appetite.

The appetite
of every parti-
cular part.

on of our nourishment till there be a supply made, we should by degrees be extinguished being affamished before we were aware; for our substance is in perpetuall wasting and decay; the inbred heate continually feeding vpon the Radicall moysture. But now it is otherwise, because the naturall hunger that is settled in euery particular part, hath with it adioyned a sence of discontent, which is onely appeased by assimilation of fresh nourishment.

Why the
brain being
stroken, the
patient casts.

These branches of Nerues going downward, make his membranes which were onely membranous before, to become neruous, being disseminated euen to his bottome. These doe also improue the nourishing force or faculty to the fleshy Fibres of the stomacke. From the left nerue there runneth a branch along the vppermost seate of the stomacke to the pylorus, which when it hath foulded with a few small furcles, it goeth thence to the hollow of the Liuer. To the bottome of the stomacke do other two nerues attaine from the sixt paire also, to wit, from the propagation led by the roots of the ribbes. Sometimes to the left side there are offered nerues arising from the sinewes which runne vnto the spleen.

Why the
brain being
stroken, the
patient casts.

Wherefore seeing the stomacke hath obtained so many sinewes, it is no wonder if when the braine bee stroken or affected, the stomacke also bee disturbed, and vomitings caused which happens also in the *Hemicrania* or Meigram: & on the other side when the stomack is affected, then the Animall faculty languisheth, & melancholly symptoms do happen: so that one of them suffering the other hath euer a compassion, not as most men haue of others miseries, but indeede a reall fellow feeling.

Vessels from
the bladder of
gall to the bot-
tom of the sto-
macke.

Furthermore, there attaineth to this bottome of the stomacke, sometimes a vessell or entrance of many vesselles from the bladder of Gall, carrying choller thither and causing perpetuall casting. A Family of such men are said to be at *Spire* in *Germany*, all of which family euery third day vomit vp a good quantity of Choller, & they be called *πυροχόλοι* *δυνα*, that is, casters of choller vpward.

The vse of the
stomacke.

The vse of the stomacke is to receiue meate chewed with the teeth, and drinke altered in the mouth through the gullet, and the same to retaine hauing contracted it selfe, and embraced them by closing both his orifices; and then his naturall inbredde faculty and proper heate, boyleth and conuerteth the better part of the Aliments into the white cream, which we call *Chylus*; that is, a substance disposed to be conuerted into bloud. For the proper action of the stomacke, sayth *Galen* 5. *usu partium* 4. is concoction, it being the organ or instrument of the first concoction, or the shop and forge of Chylification.

Galen.

What parts
assist the sto-
macks con-
coction.

Moreouer, because the substance of the stomacke is membranous, and therefore not so hot, his ingenit heate is encreased, yea doubled by the adiacent parts; as the Liuer, the Midriffe, the Spleene, the Kell, the Collicke gut, the trankes of the hollow veine and the great Arterie, the Sweet-bread; but especially the *Celiacall* Arterie, compassing it about almost on euery side yeeldeth most immediate assistance. For the narrower side of the stomacke toward the right hand, is in a manner hid vnder the Liuer; the left lieth close to the Spleene and so of the rest, which are all as so many coales set together vnder the vessell to make it boyle. After the Aliment is concocted, the pylorus or lower mouth of the stomacke is loosened, and the *Chylus* thrust downe into the *duodenum*, from thence to supply Aliment to the whole body: and so much of the stomacke.

Of the Oesophagus or Gullet. CHAP. X.

The reason
why we dis-
course of the
gullet in this
place.



The names.
*Hip. lib. de re-
sect. corpor.*
*Gal. 6. usu par-
ti. 5.*
Aristot. 1. hist.
Animal. 16.

Now although the *Oesophagus* or gullet is (for the most part of it) scituated in the Chest or second Region; yet because it is continued with the stomack, in substance, membranes and fibres little differing from it, being nothing else, but as it were a production of the same, we will intreate of it in this place, and not in the second Region, the rather because the Table wherein the stomacke is deciphered, containeth also the delineation of this *oesophagus*. It is called therefore in Greeke by *Hippocrates*, *Galen*, and *Aristotle*, *οισοφάγος* from *οἶσος* *καὶ* *φάγνμα*, which signifieth to carry meat, as also *σώμαχος* the stomack, from words that signifie length and narrowness. For indeed this name of the stomacke is proper to this part, albeit other authours, especially our English tongue hath turned it to signifie the ventricle or place where the meate is containd; the true stomack we call the gullet: the Arabians call it *meri* and *vescet*, the Latins *Gula*. It is the common way of meat and drinke from the mouth into the ventricle or stomacke as we call it, which all creatures haue

haue that draw breath. This part taking his beginning in the lowermost cauitie or hollownesse of the throate, at the rootes of [table 10. figure 1, 2. A, the orifice of the gullet cut from the throat] the round behind the larynx or wezon to whom it is tyed, and on either side toucheth the Tonfils or Almonds [tab. 10. fig. 1, EE] and passing through the necke & the breast, betwixt the wezon and [as appeareth in the table belonging to the chap. of the Lungs, figure 1, 2. where A sheweth the gullet, and B the arterie] the spondels of the necke and breast vpon which it leaneth; (for it might not passe through the middle cauitie of the brest, lest it should trouble some Instrument of breathing, and beside it stood in neede of some settled supporter and that farre within, to leane vnto, that so it might be safe from externall iniuries) it goeth directly [tab. x. fig. 1, 2. from A to B] to the first Spondell of the breast, where it enclineth it selfe a little to the right side, that it may [tab. x. fig. 1. from B to C] giue way to the trunk of the great Artery descending, which comming out of the left Ventricle of the heart, goeth necessarily to the left side ward. When it hath atteyned to the ninth Spondell, it is lifted aloft by the helpe of certaine Membranes, and passeth a boue the great Artery, least in the descending of grosse and thicke meates, it shoulde lye heavy vpon it, and hinder the course of the arteriall blood and spirits. Then againe it enclineth to the left side [tab. x. fig. 1 from C to D] where the vppermost mouth [tab. x. fig. 1. 2 G] of the stomacke is scituated, and going vnder the hollow Veine, passeth through the Neruous part of the *Diaphragma*, by a posture of his owne into the lower belly, and is implanted not into the right, lest it should necessarily perforate the Liuer, but into the lesse orifice of the stomacke, together with two Nerves [tab. x. fig. 1. 2. T V.]

In his originall or rising, it is tyed to the throate by a coate that compasseth the mouth, but to the stomacke (where it groweth to the *Diaphragma*) by the continuation of his body to the bodies of the Spondels; to the wezon and the parts adioyning by the helpe of Membranes proceeding out of the Ligaments of the backe.

His figure is round, [tab. x. fig. 1, 2] both that more matter might passe in lesse roome, (for of all figures the round is most capacious) and that it might be safer from iniuries. Very long it was of necessity to be, because the mouth is farre from the stomacke; and it may well be called a reddish gut, for after that manner it is distended into a sufficient capacity, that the meate should not stay in it, or pressing the wezon hinder respiration, and put a man in danger of choaking.

The substance of it is in a meane betweene flesh and sinnewes, (wherefore it may bee both enflamed and subiect to convulsion also:) sinnewy or membranous, that it might be extended into length and breadth when the meate is put in, and againe fall, that it take not too much roome when it is empty; fleshy it is also, that being soft it might giue way vnto the meate as it passeth downe. But because as a sacke to be filled with Corne, vnlesse it be held vp and open, doubleth into it selfe when the corne is powred in; so least the gullet being soft, should double into in selfe, when the meate is powred into it; it is supported and held open by his connexion to the bodies of the Spondels. Hence it is, that lying vpon the long ridge bone, when it is affected we apply Cataplasmes to the ridge of the back. It hath three Coates, one common and two proper. The first bred out of the Ligaments of the Spondels, which is the Case or couer of the two proper Coates. The second, which is called the externall, is fleshy and very thicke, as if it were a pertorated Muscle, and hath his originall from the second Cartilage of the wezon, as it lookes toward the necke, and hath onely transuerse Fibres, that with these the Aliment that is drawne by the fibres of the inner coate might be more readily thrust into the stomacke; they are also a great help when the stomack violently laboreth to vomit vp any thing that oppresseth it: which two things are after a diuerse manner performed. For if the fibres do beginne to be contracted aboue, they serue to swallow with: if from the Orifice of the stomacke, for vomiting. The thirde coate is internall, and of a dissimilar substance, vnder or within whose inward superficies, a certaine smooth and slippery veyle or wimple is substrated, hauing right and slender fibres to draw the nourishment after the mouth hath receyued it. The remainder of his substance from which that veyle or filmy couering like the Cuticle from the skin may be separated, is Neruous and more Membranous then the externall, more harde also and sensible, that the pleasure and good relish of meats and drinckes may be better apprehended by contaction or touching. This Coate ariseth from that which inuesteth the palate, the mouth, lips, and throate; and runneth as farre as the left Orifice of the stomacke. It hath very few oblong fibres, lest they should keepe the meate too long in the gullet, which would haue

To what part
it is tyed.

The Figure
of it.

The substance

His connexion.

The 3. coates
of the gullet.

beene a great annoyance to the wezon. That these may be the better obserued, they had neede be parboyled, to take away their abundant moysture.

The act of
swallowing.

The act of deglutition or of swallowing, is a worke mixed of an Animal and Natural, & is helped by certaine muscles called *oesophagæi*, belonging to the gullet; but they are accounted among the muscles of the wezon, which proceeding from the sides of the gristle called *Thyroïdes*, doe wholly embrace the gullet, and being parted by a right line, are inserted into his middle part, as we shall see more at large in the booke of muscles.

The Glandules
or Tonils
called the Al-
monds.

For the facilitie of swallowing, the cavity of this gullet is alwayes moystened by the glandules that are set neare vnto it. In the throate by the glandules that are common to the gullet and to the wezon, which containe the spittle, and [table 10. figure 1. EE] are called *Tonsilla* or the Almonds; again, by a glandulous body that on the backpart, [table 10. fig. 1. 2. FF] and toward the sides groweth to his middle passage, commonly in a Calfe called the sweet-bread; as well to moysten his cavity and defend him from the hardnesse of the spondels, as also to hold him steady from inclining to either side.

His vessels.
Veines.
Arteries.

It hath veines (but very few) from the hollow veine and the Coronarie branch of the [table 10. figure 1. 2. dd] port or gate-veine; Arteries from the great Arteries descending trunk, and from the coronarie branch of the *Celiacall* Arterie [table 10. figure 1. 2. dd]

Nerves.

His Nerves are very notable, coming from the sixt paire [table 10. figure 1. 2. TV] which for security sake are carried side-long; (the oblique way being much more safe then the right) for, being soft and slender, and to be led a long way, they might easily bee stretched or broken by the waight of the stomacke, if they had been led right on: which nerves when they haue encompassed the gullet round, at length are fastned in the stomacke, [tab. 10 fig. 2. XY.]

The vse of the
gullet.

The vse of this *oesophagus* or gullet is, that by it as it were by a tunnell, the meate and drinke, a little altered in the mouth, and turned ouer the rootes of the tongue by his muscles to the begining of this gullet, might by it be receiued, whither when it is arriued, the throat and parts of the gullet about the meat closing themselves, and those below being dilated, the meate and drinke are driuen downe into the stomacke.

An obserua-
tion with the
reason of an
vncouth acci-
dent.

It is worth the obseruation, that with some men solid bittes finde freer passage then liquid drinks or broths, which are often returned into the nose, and this hapneth vsually in those who haue beene long afflicted with the Chollicke: as also in a false squinacee.

The cause of this accident is to bee imputed to the resolution of the muscles of the choppes, for solid things with their waight offer a kinde of violence to the muscles, and make their owne passage, but liquid things cannot doe so. Although I am not ignorant that there may also be another reason rendred hereof, to wit, a tumor or inflammation of the glandules before mentioned; for solide meates doe presse them and so open the cavity, to make way for themselves.

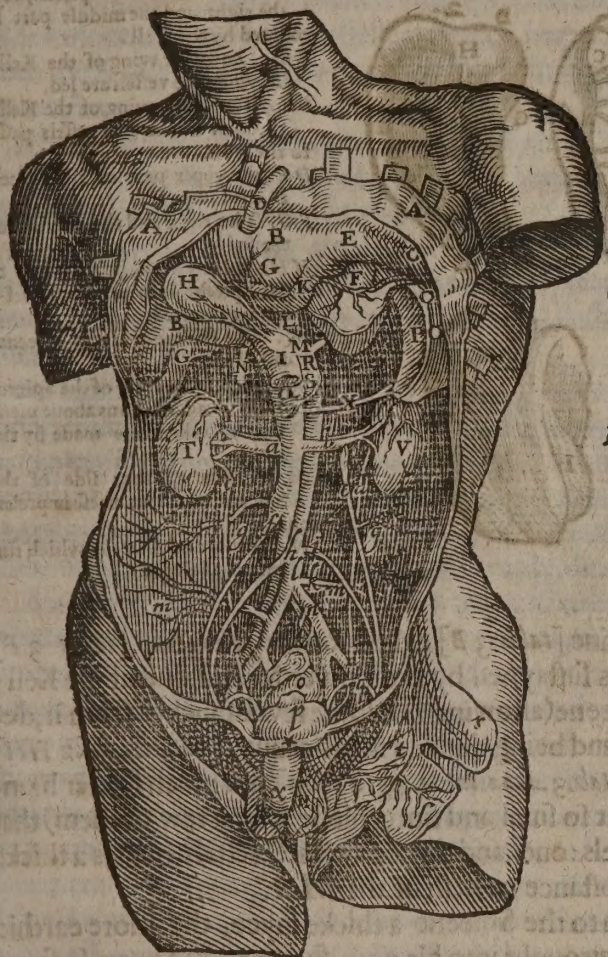
CHAP. XI. Of the Spleene or Milt.

THE Milt is called in Greeke *σπλήν*, because it draweth away the droffe of the bloud, as they say Lupines among wheate doe sucke away the bitternesse of the earth; in Latine it is called *Lien*. It is placed in the [table 11. 00] vppermost part of the inferior *venter* or lower belly, in the left *Hypochondrium*, vnder the midriffe towards the backe: wherefore in hayle men it cannot bee felt, but in those that haue swollen spleenes, it may not onely be felt, but sometimes seene to bunch out a good way in the *Abdomen*. The embowed part [table 11. 00] resteth vpon the spondels and bastard ribs which are a defence vnto it; the concaue or hollow part [table 11. P] turned to the right side, is opposite to the Liuer, as if it were a left Liuer. It is seated either higher or lower in diuerse bodies, betwixt the stomack & the ribs, for there onely was a roome empty for it. Commonly there is but one spleene, yet sometimes two and three; one on the top of another; neuer of an equall bignesse, but distinct in their coates and vessels: it is wondrous rarely absent, and very rarely doth it change places with the Liuer, that it should be in the right side, and the Liuer in the left. It is knit to the Rimme or *Peritoneum* and the *omentum*, sometimes more outwardly to the *diaphragma*, and to the externall membrane of the left Kidney with very slender membranes, arising from the *Peritoneum* where it compasseth the *Diaphragma*, for it had not neede of so strong bands of the Liuer, because

because it is nothing so waighty; sometimes inwardly, forward to the stomacke, backward to the backe alwayes, by the interposition or mediation of vessels and of the vpper Membrane of the *Omentum* [tab. xii. fig. 2 C C] which cleaueth to the Line [tab. xi. P. Tab. xii. fig. 2 H H] of the Spleene.

It varieth much in his Magnitude, colour, and figure. For in a man it is thicke and great, but much lesse then the Liuer, that it may not hinder the dilatation of the stomacke. In some men it growes greater; for by reason of the loose rarity of his substance, it easily encreaseeth by the affluence of humors; especially it groweth in those men in whom naturally there is more plenty of Melancholy iuice: and although this humor in respect of the Choller and Vrine be but little, yet because it must be drawne a long way, and is stubborne

TABVLA. XI.



O O. The fore-side and hollow side of the Spleene, which also sheweth how his position is in the body of Man.

P. A Line into which the Vessels of the Spleene are implanted.

and refractory by reason of his thicknesse and vnwilling to follow, therefore the Spleene is ordained somewhat the bigger. It hath not alwayes the same colour. For in an Infant when it is nourished with pure blood defecated by the mothers Spleen, it is red like the Liuer; but in growne bodies where it is nourished with a thicke iuice, it is more then rufser toward blacke; for such is the naturall colour of the Melancholy humor. But in those that are diseased in their Spleenes, such as is the humor that offends, such is the colour of the Spleene, Liuid, Leaden, Ashy or Leeke greene; sometimes it is couered with a coate very like a Cartilage, in colour, thicknesse and hardnesse; in Dogges it is of a brighter red then the Liuer.

His Figure [tab. xii. fig. 2] he varieth according as the parts which lye neere him do require, yet is alwaies so long as the vncovered or naked left side of the stomack will admit. It is also broad and somewhat square like an Oxe tongue, or as *Hippocrates* hath it, like the soale of a mans foote. Aboue it is broader and ends in a double obtuse & blunt Angle or corner. Below narrower and ends in one narrow corner or angle. Without and on the left side, and as it looketh to the *Diaphragma*, somewhat gibbous or embowed, so that it hath a little representation of a globous or round figure. Sometimes from the ribs it hath [tab. xii. fig. 4. L L] certaine impressions or distinctions. Inward, and on the right side somewhat concauons [tab. xii. fig. 2. betweene H H] or hollow, that it might giue way, or rather enclose the stomacke, and so further his concoction. Through the middle length of this

cavity

The colour;

A good note;

The Figure;

cavity, runneth a white line [table xi. P and tab. xii. fig. 2 HH] which hath some rising inequalities in it, which receyue the Veines and the Arteries [Tab. xii. fig. 2 N] and the Kell, [tab. 12 fig. 2 BB.] as followeth.

The second Figure sheweth all the sides of the Spleene taken out of the body. The first peece the fore-side with a part of the Kell and his vessels. 2 the hollow side, 3 the gibbous side, the 4 sheweth the impressions which sometimes it receyueh from the Ribbes, the 5 sheweth the hollow side slit open.

TABVLA XII.



- A. The left side of the Spleene, for the right and the middle part is covered by the Kell.
 B B. The lower wing of the Kell, in which the vessels are led.
 C C. The upper wing of the Kell, through which the vessels passe to the stomacke.
 D E. the upper part of the Spleen D, the lower E.
 F G. The right and the left side of the Spleene.
 H H. A Line in the hollow side of the Spleene into which the vessels are inserted.
 I K. The substance of the Spleene dissected.
 L L. The gibbous side of the Spleen, with the impressions above mentioned, which are made by the ribbes.
 M M. The gibbous side of the Spleene, without these impressions.
 N. Veynes and Arteries which run vnto the Spleene.

The Splenicke branch of the Gate-veine [table 3 B] called *Ramus splenicus*, [table 3 F] below the Liuer is sent (a great bow it is sustayned by the Lower Membrane of the Kell) [tab. xii. fig. 2 BB] ouerthwart to the Spleene (allowing first some few branches from it, described in the history of the port-veine) and being diuided in his cavity, [tab. xii. fig. 2 HH] is spent in his substance [tab. xii. fig. 2 IK tab. 3. aaaa. tab. 4. fig. 2 ll m] into much smaller branches, not conspicuous as in the Liuer, but so smal and fine (vnlesse it be a few of them) that they rather seeme to be Fibres then vessels: ouer and through which vessels, runnes a thicke and grosse blood, making the proper substance or flesh of the *Milt*.

The course of the Melancholy humour.

How Melancholy prouoketh appetite.

Vas breue.

Vomits how good in quartane Agues.

This *Milt* or Splenicke branch carrieth to the Spleene a thicke iuyce, the more earthie part of the blood, that there it might be wrought into his nourishment. But because some part of this iuyce is so grosse that it cannot be attenuated by the Spleene, and therefore as vnprofitable must be segregated or separated, there are ordained two kindes of Vesselles to receyue it; one which belcheth it out vpward into the left side of the bottome of the stomacke, sometimes vp higher toward the left orifice, where with his sowrenesse he stirreth vp the Apperite after the Chylus is gorten into the Veins of the Liuer: so wee imitate nature, when wee make sowre or sharpe fauces at supper, to prouoke and recall our appetite which by our dinner was extinct and lost. Again, this humour hauing a binding faculty, strengthneth the stomacke, that his actions may be more firme.

This regurgitation or belching of melancholy, is made sometimes by three, sometimes by many branches proceeding from the Splenicke branch; sometimes by one, proceeding from the vppermost branch nere the Spleene, which *Galen* calleth *Vas breue*, that is, the short Vessell, described before in the 3, and 4. Tables. Hence comes sometime castings of a blacke humor, which is after carried downe the guts with the Chylus, and so excluded. This Vessell also is of great vse in Quartane Agues; for by it such patients are to good purpose by vomit purged, before and after the fit: for in these Agues, as also almost in all melancholy diseases, not only the *Milt* but the mouth of the stomacke is affected. There is also another vessell by which this humour is carried downward, which beeing inserted at the end of the right gut, maketh the inward Hæmorrhoidal [tab. 3 g g. tab. 4. fig. 2, *] Veines, for the outward come from the hollow veine; although this humour bee often purged

purged by the Arteries, not onely into the guts, but more often into the emulgent veines, and so through the Kidneyes into the bladder. And so wee imitating Nature in melancholy diseases vse *diureticks*, or medicines prouoking vrine.

*Diureticks
medicines in
quartane a-
gues & mel-
ancholly di-
seases.
The arteries;*

The spleene also receiveth many Arteries (more then the Liuer) and these very [table 4. figure 1. n.] great, the Coeliacall [table 4. figure 1. m.] which commeth out of the *Aorta* or great Arterie vader the *Diaphragma*, after the same manner and with the same number of diuisions that the veines haue, not onely that they may afford him life, but also that by their perpetuall motion they might preserve in good state the body of the spleene, by ventilating, cherishing and refreshing his naturall heat, almost oppressed with a drossie iuyce, which iuyce they change into a thicke blood for the spleenes nourishment, and the drossie is purged or auoyded away as we haue sayde. Beside, these Arteries carry to the *Aorta* wheyey humors, together with a thin and cold blood, which are received by the *Anastomosis* or inoculation of the vesselles; which humours by the emulgent Arteries are deriued into the Kidneyes; and from thence comes that quantity of vrine or whey which is in the great Artery.

The nerves;

It hath Nerves inserted into his coate very small ones, from that branch of the sixt paire which commeth from the rootes of the ribbes on the left side, but whether they passe farther into his substance we yet doubt.

It hath but one coate, and that very thin, springing from the membrane of the Kall, which we sayd claue to the right line of the spleene, and was a production of the *Peritoneum*, which coate compasseth and defends his flesh on euery side, because it is very soft and loose.

His substance [table 12. figure 5. I K.] seeming to bee nothing else but a thicke blacke and congealed blood full of fibres, for it is a *Parenchyma* as *Erasistratus* called it, or a fleshy affusion, very soft, thin, loose and spongiouse, that it might more easily draw thick iuyces from farre (for a spongie substance is fitter for that purpose then a fast and firme) and giue them entertainment: wherefore also the veines disseminated through it, are softer and looser then others, that the humour may more easily, though it be thicke, fall out of them.

*The flesh or
Parenchyma;*

The vse of the spleene, *Erasistratus* thought to bee none at all; inconsiderately accusing Nature to haue framed it in vaine. The receiued opinion is, that it was ordayned to bee a receptacle of the crasser and more foeculent part of the blood, made and separated in the Liuer, like as the bladder of gall is the receptacle of yellow choller; that the blood being thus on either hand depured, might passe more cleare and neate to nourish the body, and especially the principall parts. This thick and impure blood yet mingled with much good and laudable, the spleene by the spleenicke branch of the gate veine, by an inbred faculty draweth vnto it selfe as familiar and of kin vnto his substance, which albeit the veins of the Liuer could not change, yet the spleene by reason of the perpetuall motion of his many & large Arteries worketh it into his owne nourishment: of which notwithstanding there remaineth an vnprofitable part which it belcheth out into the stomacke, by the *short vessel* to stirre vp appetite by his aciditie and sharpnes, and by his adstriction to corroborate and confirme the actions of the stomacke. But against this common receiued opinion, *Bauhine* in this place annexeth a long discourse, full of wit, but how consonant to truth, I will leaue to others to iudge. It shall be for the present sufficient to make his conceite knowne vnto you.

*Erasistratus;
The receiued
opinion of the
vse to the
spleene.*

If the spleene, saith he, had onely beene appoynted to stable an excrement, it should not haue been seated in the vpper but in the lower part of the *abdomen*, as the other receptacles of excrements are: for so would it more commodiously haue receiued so heavy and earthy an excrement.

*Bauhines con-
ceit of the vse
of the spleene,
His argu-
ments.*

Againe, seeing of all the humours there is least quantity of this melancholy, Nature would not haue made the spleene bigger then the bladder of gall, if shee had not intended some other office for the spleene, beside the receipt of melancholly.

Moreouer, if this had beene her only end, she would haue framed in the spleene a large cavitie where this humour might haue commodiously beene enterdayned, as she framed a cavitie for the choller in the bladder of gall.

Fourthly, we must know and vnderstand that no part ordayned for the separation of excrements, doth receiue & naturally auoyd them by the same passages, as we may perceiue by the Kidneyes and the bladder of gall. Fifthly, no part is nourished by the excrement which it attracteth but by laudable blood. Sixtly, as the passages of choller are disperfed through

through the substance of the Liuer, among the rootes of the gate and hollow veines, to draw away the excrementitious choller. So also should there haue been many propagations and tendrils from the spleenick braunch, disperfed through the substance of the Liuer, which we finde to be nothing so.

Finally, if from the Liuer the foeculent blood bee purged away, as an excrement into the spleene, then it must of necessity follow that this excrementitious humour should regurgitate or returne into the trunk of the Gate-veine, because the spleenick branch ariseth out of the same trunk far vnder the Liuer, and about the trunk of the *meseraicks*,

Wherefore we think, sayth *Bauhine*, that the spleene was ordained and instituted by Nature, for a further confection of some kinde of blood. Which vse, *Aristotle* first allotted vnto it, and therefore in his third booke *de partibus Animalium* and the 7. chapter, hee calleth it a bastard Liuer. The same also *Galen* giueth assent vnto, in his booke *de respirationis usu*, as also *Aphrodiseus* and *Aretæus*: *Vesalius* and *Fernelius*, touch vpon this vse of the spleene also; but *Platerus* and *Archangelus* resolute vpon it very confidently.

The spleene therefore from an inbred faculty of his owne, draweth vnto himselfe the thicker and more earthie portion of the Chylus, somewhat altered in hauing receiued a certain disposition or rudiment of blood in the *meseraicke* veines, by the spleenick branch of the Gate-veine, out of the trunk of the *meseraicke* veines before the Chylus get into the Liuer; that so the Liuer may the better draw the more laudable parts of the Chylus, for otherwise the small vessels of the Liuer being obstructed by the crasse and crude blood, not onely sanguification would haue beene interrupted; but also the Jaundise, Dropsies, Agues, Scirrous hardnesse, and many other mischiefs, would haue ouertaken vs of necessity, all which we see do euery day happen when the spleen fayleth to do his duty; & either through weaknesse, or obstructions, ceaseth to attract that crasse and foeculent part of the Chylus. But a great euidence of this truth is this; that the spleenicke branch doeth not proceede from the Liuer, but ariseth as is sayde, and is seated below it. Neither is it likely that so thicke a iuyce confection and made into blood in the Liuer, should get out of it by the hairie and threddy veines of the same; yet we do not deny that melancholy iuyce is ingendred in the Liuer; but we say, that that onely is there ingendered which is a part of the masse of blood, not that which is receiued into the spleen, for his nourishment and the vse of the stomacke.

Furthermore we are of opinion saith *Bauhine*, that a part of the Chylus is sucked euen out of the stomacke, by veines ariuing at the left side of his bottom from the spleenicke branch. When the spleen hath receiued this Chylus a little altered in the long iourney through those spleenicke surcles and branches, it laboureth and worketh it at great leasure, and by long processe, as the Alchymists say, and much preparation in the innumerable small vessels or Fibrous complications which are disseminated through his substance (like as the other and greater part of the Chylus is laboured into blood in the complications of the vessels disseminated through the Liuer) and boyleth it into a thinner consistence by the help of naturall heate assisted by the many and large Arteries, and their perpetuall motion. And then a part of it becommeth the Aliment of the spleen, the rest is carried by veines issuing from the spleenick branch, to nourish the Stomacke, the Guts, the Kell, and the Mesentery; which thing *Galen* also insinuateth, when he sayth, That the same *meseraicke* veines do carry Chylus vnto the Liuer out of the stomacke and the guts, and returne blood againe vnto them and the *omentum*. For seeing that the originall and substance of all the veines which are propagated from the gate-veine is one and the same; it followeth necessarily, that their action also should be the same; but to returne.

A part also happely of this humour thus altered is drawne into the next adioyning arteries, and so conueyed into the great Artery, to contemperate the intense and sharp heat of the blood in the left ventricle of the heart, and to establish and settle the nimble & quick motions of the vitall spirits, which are a very great cause why some mens wits are so giddy and vnconstant.

Sometimes it falleth out in great and confirmed diseases of the Liuer, when his sanguification is decayed or in a manner perished, that the spleen performeth his office, and transmitteth a part of the blood by him laboured through the spleenicke branch vnto the veins of the Liuer, which through the rootes of the hollow veine and the branches thereof, is distributed into the parts of the body for their nourishment, euen as the blood is wont to be distributed, which is laboured and confectioned in the Liuer it selfe.

But

Authors on
Bauhine side.
Aristotle.
Galen.
Aphrodiseus.
Aretæus.
Vesalius.
Fernelius.
Platerus.
Archangelus.

Bauhine pro-
iect,

Galen.

But that part of the altered Chylus that before we sayd was drawn into the spleen, which it cannot by reason of the thicknesse thereof transforme into profitable iuyce, but is altogether vnapt for nourishment, is poured out, part of it into the stomacke, part into the *Hemorrhoid* veines; sometimes through the trunk of the gate veine, or through the splenick Arteries it is deriued vnto the Kidneyes, whence it is that in diseases of the Spleene, the water fals out often to be blacke.

why in affect
of the spleene
the vrines are
often blacke

Wherefore wee conclude saith *Bauhine*, that the Spleene is a great helpe to the Liuer for the confection of blood; partly because it maketh blood answerable to his owne Nature, partly because it auerteth or draweth aside vnto it selfe the thicker part of the aliment, not so fit to make pure blood, and by that meanes the Liuer, vnburdened of such a clogge, performeth his office of sanguification with more facility. And thus it may be sayd verie well to purge and defecate the blood, and to make it more pure and bright. And heereupon the Ancients placed the seate of laughter in the spleene: and *Plato* saith, that the spleen polisheth and brightneth the Liuer like a Looking-glasse, that it might make a more cleare representation of the Images of the passions from thence exhibited vnto the soule.

Plato

Aristotle also calleth it a left Liuer, and obserueth that those creatures which haue no Spleene haue as it were double Liuers: and *Galen* remembreth in his fourth Booke of the vse of parts, and the 7. chapter, that *Plato* calleth it the expresse Image of the Liuer.

Aristotle

It is therefore not to be wondered at, if the diseases of the Spleene doe no lesse (haply more) hinder sanguification then the diseases of the Liuer it selfe, because by how much the better the spleene doth his duty, by so much the blood in the Liuer is more pure and cleare.

In Dissections also we often finde, that the Spleene exceedeth the Liuer in magnitude, or is equall to it, being yet found in colour and consistence.

Notwithstanding, albeit in both these entralls, when a man is sound, and hayle blood is generated, yet it must needs be confessed, that there is more store of good & hot blood fit for the nourishment of fleshy parts made in the Liuer then in the Spleen, whose blood is neither so much, nor so hot, nor all out so good; which *Hippocrates* intimateth when he saith, that the same things which make the Spleene to flourish, make the body to wither and consume.

And thus I haue acquainted you with *Bauhines* conceits of the vse of the Spleen, wherein me thinks he acquitteth himself, as *Bellarmino* doth in his disputations of the sufficiency of works in our Iustification, who after that in diuers Books, and by manifold arguments hee endeoureth to proue that works may iustify, yet in the end he concludeth, that it is more safe onely to trust to iustification by faith; so *Bauhine* for all his former arguments, yet you see concludeth, That the more, better and warmer blood is made in the Liuer: as if hee should say, there is a little & cold blood made in the spleene, not fit to nourish the fleshy parts, but onely his owne substance, which I thinke no man will deny vnto him. But of this question we shall see more heereafter in the Controuersies; we will now put an end to our discourse of the Spleene, adding this one vse more of it; That with his in-bred heate, and the many Arteries wherewith that heate is encreased, it furthereth the concoction of the Stomacke.

Bauhines cau-
telous conclu-
sion.

CHAP. XII. Of the Liuer.

THE Liuer is called in Greeke *ἥπαρ*, from a word that signifieth *Want*, because it supplieth the want of al the parts; or from making merry, because in this part is the seate of concupiscence. The Latines call it *Iecur*, as it were *Iuxta Cor*, because next to the heart his power is most eminent. It is worthily numbred among the principall parts, as being the seate of the naturall faculty, and of the nourishing part of the soule, common to all sanguine or bloodie creatures: and first of all the Entralles or bowels it is perfected in the mothers wombe.

The notation

A principall
part.

It is the beginning of Veines, not in respect of their originall, which is seed (for the vessels are made before the *Viscera* or entrals) but in respect of their rooting & distribution; for from hence spring two great and long Veines; below out of his cavity or hollownesse the Port or Gate veine; about out of his conuexity or embowed side, the hollowe veyne

The begin-
ning of veines.

is

is sayd to proceede, albeit indeede the hollow veine groweth to his backe [tab. xiii. Fig 1, FG. fig. 3 MN] part, with two notable branches disperfed through his substance, which two vesselles arise out of the Liuer (the *Parenchyma* or flesh of it being compassed about their roots as the earth is about the roots of a tree) and doe minister nourishment to the whole body, wherefore the Liuer is called the shop of sanguification or blood-making.

His situation

It is placed in the [tab. 6. lib. 2. FF tab. 9. CC] vpper part of the lower belly, that being set in the midst as it were of the body, it might send blood equally vpperward and downeward; it is about a fingers breadth distant from the *Diaphragma* least it should hinder his motion; in dead bodies sometimes it toucheth it, and is covered wholly by the ribbes. It taketh vp the greatest part of the right *Hypochondrium*, partly that it may leaue the left for the stomacke [table 6. Lib. 2. FF. table 9. FF] and the spleen [tab. 9. G] (for these three occupy both sides; whence it is that when any of them, much more when all are swelled, there followeth great difficulty of breathing) partly because the blood might be better carried to the right ventricle of the heart. It leaneth but lightly vpon the vppermost, foremost, and right side of the stomacke [see the tab. 6. lib. 2. and tab. 9.] least it should presse it with his waight, and driue forth the matter contained in it. A little part of it also reaching toward the left side, that the body might be ballanced. In Dogs it taketh vp well neere both sides, because their spleenes are long and narrow, but the greatest part is compassed below with the bastard ribs which defend it from iniuries.

The Figure.

His figure is diuerse, because of the parts [table 13. figure 1. 2.] adjacent, for his office. Table xiiij. sheweth the Liuer with his Veines.

The first Figure, the Gibbous and forepart.

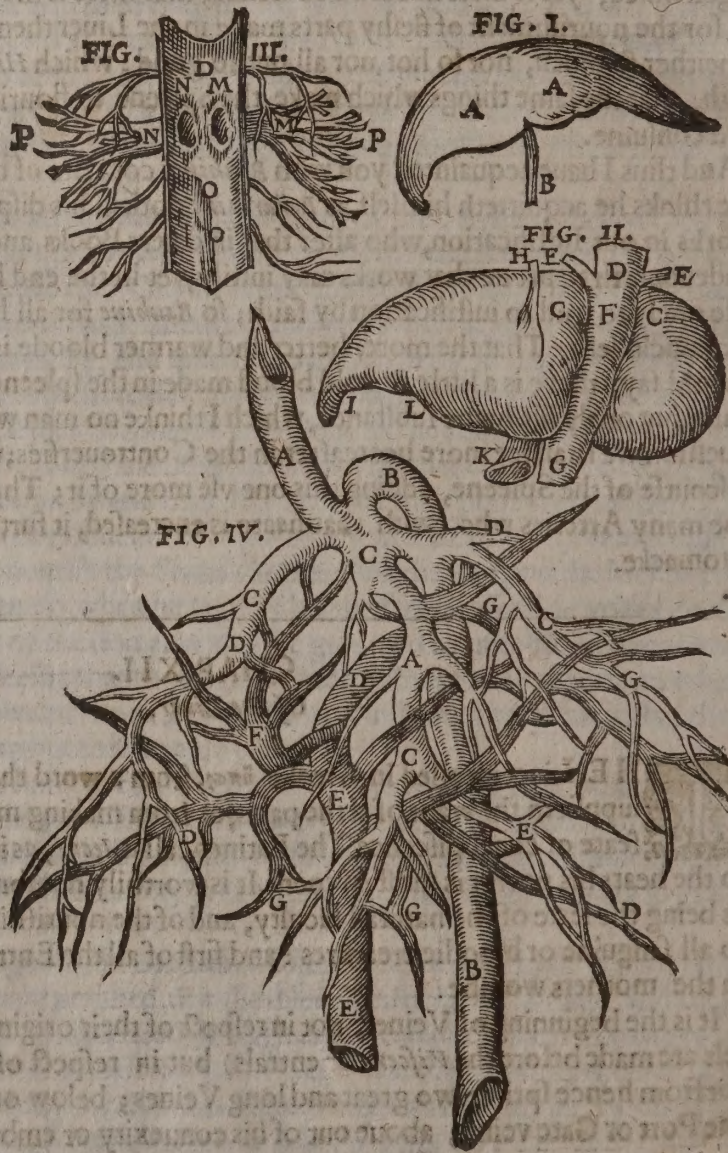
The second Figure, the Gibbous and hinder part, together with a part of the trunk of the hollow veine.

The third Figure, a part of the hollow veine fastned to th backside of the Liuer, and is opened with a long slit, to shew the holes of his branches where they open into the Liuer.

- AA 1. The Gibbous and fore side of the Liuer.
 B 1. The Vmbilicall veine.
 CC 2. The gibbous and backside of the Liuer.
 D 2, 3. The seate of the hollow veine where it passeth through the midriffe.
 E E 2. The veines of the midriffe called *Phrenica*.
 FG 2. In this distance is the place where the trunk of the hollow veine groweth to the backside of the Liuer.
 H 2. A Ligament which tieth the Liuer to the midriffe.
 I 2. A Ligament tying the left side of the Liuer to the midriffe.
 K 2. A part of the Gate-veine.
 L 2. The bosome of the Liuer into which it admitteth the left orifice of the stomacke.
 MN 3. Certaine branches of veines proceeding out of the Liuer.
 OO 3. Smal branches which are thrust out of the Liuer to the hollow veine.
 PP 3. The roots of the hollow veine disperfed thorough the Liuer.

The fourth figure sheweth the roots of the Hollow and Gate Veines disperfed through the Liuer and their Anastomoses or inoculations.

- A. The trunks of the hollow veine arising vpperward from the Liuer.
 B B The trunk of the hollow veine, as it getteth out of the Gibbous part of the Liuer, which is bent downwards, and watereth all the parts of the body vnder the Liuer.
 C C C C. The roots of the hollow veine which are in the substance of the Liuer.
 D D D D. The ends of the roots of the hollow veine which pierce or open into the midst of the roots of the gate-veine.
 E E The principal trunk of the gate-veine.
 F F The roots of the gate-veine, even all those that are black, disperfed through the substance of the Liuer, which vnder the lower part of the Liuer do meet, and make one trunk.
 G G G G. The ends of the rootes of the gate-veine which pierce or open into the midst of the roots of the hollow veine.



requires

requires no proper figure: but a sufficient magnitude and thicknesse.

The forme of it is outward or inward: the outward forme or surface which is the vpper & more backward part is smooth, equall and conuexe or embowed [Tab. 8. B G. Tab. 2. lib. 4. bb, Table 13, Fig. 1 AA, Fig. 8 CC] round (which is called *parts gibba*, the gibbous part or the head) that it may giue way to the *Diaphragma*, and may agree with the cavity of it; but backward it hath a [Tab. 13, Figure 2, at FG] long bosome sufficient to embrace the stumpe of the hollow veine [Tab. 13, Fig. 2 FG] lest it should be pressed eyther with the Liuers waight or the motion of the Midriffe.

The Figure,

The inward face of the Liuer which is the lower, is [Tab. 8. CC. table 11. BB. table 15, Fig. 1. BBC] hollow, vnequall, and is called the *Sinus* or saddle side, that it may giue way to the stomacke strutting [Table 9. FF. Table 11 E. Tab. 2, lib. 4 CC] with plenty of meate, and couet it immediately to cherish the first concoction of the Chylus.

In this part there are two hollowes or bosomes, one on the right side to receive the body of the bladder of Gall, [Table 15. Fig. 1, F] the other on [Tab. 13. Fig. 2, L. tab. 15, fig. 1 H] the left side, where it giueth way to the passage of the stomacke. In Dogs it hath a priuate hollownesse, whereinto it admitteth a part of the right Kidney. But where the gate-veine getteth out of it, it is vnequall, because it riseth somewhat high, least the Veines should be pressed by the racke bones. On the right side it is round [Tab. 9 CC, Tab. 13, Fig. 1, AA] and very thicke; on the left it groweth thinner by degrees, and endeth somewhat sharpe in an acute Angle; [Table 13, Fig. 2, from L to I] in the forepart also it is thin in the bought or compasse. There is but one Liuer, for the largenesse makes recompence for the number; and it is the greatest in a man of any creature for his proportion, and in the biggest men biggest, because it must make blood for the vse of the whole body; not onelie for his nourishment, but also to serue for his expence of spirits: for there are more functions of the soule in a man, then in any other creature; which functions spend more animall Spirits, and those are engendred of the vitall spirits, and the vitall spirits of blood; therefore a man had neede of good store of blood, and by consequent of a great Liuer wherewith to make it. In fearefull men and such as are giuen to their paunches, it is greater then in other men. In fearefull men, because the weakenesse of their vitall faculty comming of the cold temper of the body, might be supplied by the strength of the natural faculty. In ravenous gourmandizers, because of the abundance of the meate they eate; for as the Liuer is more plentifully nourished, so it groweth greater. For the most part the Liuer of a man is whole (that when a man goes right vp, it might couer the stomacke with the hollow part of it) [as is shewed in the 6 Tab. lib. 2. and in Tab. 5] excepting the fore and right part where there [Tab. 13. Figure 1 at B, tab. 15 Fig. 1. E] is a cleft like an outlet, which was necessary for the passage of the vmbilical or Nauel vein. [Table 6, lib. 3, from D to B, tab. 5 e. tab. 8 1. table 13. Fig. 1 B.] On the backside a part of it filleth the cavity, which both the mouths of the stomacke do leaue.

The quality of it,

The waste of spirits in man above other creatures.

In what men it is greater or lesser.

But in brute beasts it is diuided into foure, fise, or six Lobes or Finnes, which are continued or coupled together, onely by the mediation of Veynes, within which lobes their stomackes are couered as it were with the fingers of a hand, because they haue no cloathes to keepe it warme, as men haue. For if in them it were whole, when they go groueling it would not so lap about the stomacke, but hang off. Wherefore Birds because they stande more straight vp, haue it diuided but once.

It hath in men no Lobes or diuisions.

It is knit to the spine bone of the Loynes, to the *Diaphragma*, and to other parts by the helpe of the Rim or *Peritoneum*, of whom it receyueth three strong Ligaments, least being heauy, it should at any time fall. The first and right is thin [Tab. 5 D, tab. 8 H, tab. 2 lib. 4, d. Tab. 13. Fig. 2 H] like a Membrane, broad, neruous and very strong, proceeding from the Rim where it compasseth the Midriffe; and tyeth the Liuer (into whose coates it doth degenerate) forward to the *Diaphragma*, and is called *Suspensorium* or the heauing Ligament: wherefore, when the Liuer growes heauy, the Midriffe is drawne downe and in that case in respiration there is more difficulty when a man stands, then when he lies along. The second and left Ligament is also very strong, round, [table 11. C. table 2, lib. 4. e. table 13, Fig. 2, 1. table fiftene, Figure one, G] and proceeding from the Rim; it knitteth also his thinner part to the *Diaphragma*, that the sides of the Liuer may on either hande bee held vp, it sometimes also cleaueth to the Cartilages of the bastard ribs. The third Ligament is the vmbilicall or Nauell veine, now dried after [table 6. lib. 2. from D to B. tab. 5. E. tab. 12. fig. 1 B] the birth, whereby at the Nauell the Liuer is tyed down to the *Abdomen*, [table. 23.

The Connection.

Three Ligaments.

Figure 7, 8. from Z to R] lest the falling down should draw the *Diaphragma* after it. Moreover, where the beginning of the Gate-veine is [Table 11. 7] there groweth to it a portion of the *omentum*. So on the backside in the compassed face or gibbous part where the hollow veine passeth through it, it cleaueth to the Rim.

The mem-
brane.

The Paren-
chyma.

It hath a most fine and slender membrane, and but one growing from that membrane of the veines which arise from the *Peritoneum* or Rim; & this incloseth all his substance.

That substance is nothing else but blood poured out of the veines, whence it is red and soft, and standeth round about and betwixt them, as the earth about and betwixt the small bearded rootes of a tree; which blood being held in by the membrane wee last spake of, cloddeth together, and therefore of *Erasistratus* is called *παρέγχυμα*, that is, an affusion or pouring out. *Galen* calls it flesh, *Hippocrates* a fleshy *viscus* or entrall: wee with *Galen* call *παρέγχυμα*, the flesh as well of this as of the other entrals.

The empty spaces betweene the rootes of the Hollow and Port veine this substance filleth vp, as may appeare when the flesh is taken away, for so it may be we haue seene it elegantly performed, and so haue by that oculte Anatomist *Petrus Pauus* of *Leyden* neere 30 yeares since, then my first Maister and moderator in Anatomie; a lively resemblance whereof wee haue here annexed, albeit it may partly be perceiued by the precedent Table.

Table 24. Sheweth the rootes of the Hollow and Gate veines, disseminated through the *Parenchyma* or flesh of the *Liu*er, and their *Anastomoses* or inoculations: also the trunks of the *Naue*ll, *Hollow* and *Gate-veines*. Into euery one of the trunks you may put a sticke before you boyle the *Liu*er and separate his substance from the vessels, that so the vessels may appeare open, and not corrugated or crumpled vp together.

TABVLA. XIII.

- A The trunk of the hollow veine where it pierceth the midriffe.
- B A part of the midriffe.
- CC A part of the trunk of the hollow veine which groweth to the back part of the *Liu*er
- DD The trunk of the hollow veine which is carried thorough the lower belly, his branches being remoued.
- EEEE The roots of the hollow veine dispersed through the substance of the *Liu*er: these appeare here all white.
- FG The vmbilicall veine, without the *Liu*er at F. within the *Liu*er at G.
- HH The trunk of the gate vein without the *liu*er.
- II A part of the right side of the gate veine torne from his left side, that the vessels might better bee demonstrated: but the trunk of the gate veine HH. should haue ridden ouer the hollow veine DD.
- KKKKKK The roots of the gate vein dispersed through the substance of the *liu*er, which here appeare all blacke.
- LLL The *Anastomoses* or inoculations of the gate veine with the rootes of the hollow veine.
- M This inoculation is like a Pipe or trunk, and it is a common and continued passage, into which you may put a good big Probe: from this there are open passages into the last strings of the gate or hollow veine.



The rootes of
the great veins

There are also a few Arteries inordinately shed through his substance amongst the other vessels. But there are more rootes of the port veine [table 13. Fig. 4. Tab. 14. the blacke rootes belong to the gate veines] in his lower part, and fewer in his vpper, and on the contrary

trary many more [table 13, Fig. 4. Tab. 14. the white rootes belong to the Hollow veine] roots of the Hollow veine in his vpper parts, then in his lower, (wherefore there is more plentiful sanguification or making of blood in the hollow side, and more abundant distribution in the conuex or embowed part) but all of them committed acrosse or mixt together by Anastomosis, [Tab. 13. Fig. 4. GGGG. Tab. 14. LLL] which most resemblerh the inoculation of plants; althogh sometimes the roots of the hollow Vein do fasten their ends into the midst of the roots of the Gate-vein, by which the blood runneth out of the roots of the Gate-vein into the Hollow vein, so that these roots do make *plexum mirabilem*, or the wonderfull web, texture, or plat of Veines (in respect of which it is likely the Liuer is saide to be the beginning or originall of veynes) for the perfecting and absolute confection of the blood. But there is one peculiar and notable Anastomosis or inoculation to bee obserued [tab. 14. M] which is a manifest and open pipe and continued passage into which you may passe a good bigge probe, and from which there lyeth an open way through all the least threds of the Gate and hollow Veines. And so much the rather are these inoculations of the Veines one with another, more diligently to be obserued, because through them the humors offending passe when the habite or vtmost region of the body is by Pur-gation emptied by the sidge.

Anastomosis
what it may
best be com-
pared to.

The lower [tab. 13, Fig. 4. FF. Tab. 14. KKKK] of these roots, are by little and little gathered into greater, and these into other, till at length in the lower part of the Liuer they consent together into the trunk of the port or the Gate veine [Tab. 13, Fig. 4. EE. Tab. 14. HH] as broad as a mans thumbe or broader.

The port or
Gate veine.
The Hollow
veine.

The vpper roots are in like manner [Tab. 13, Fig. 4. CCCC, Tab. 14. EEE] vnited by degrees; till at length they fall into two notable and great [Table 13, Fig. 3. MN] branches, reaching to the fore-seate of the Hollow veine, where it groweth to the Liuer, and lyeth vpon the *Diaphragma*, and there make one trunk. [Tab. 13. Fig. 2, F Fig. 3. D. Fig. 4. B. Tab. 14. AC.] Hence it is that the Gate-veine [Table 8, a] is said to arise out of the hollow side of the Liuer, and the Hollow veine, [Table 8, K] out of the conuex or embowed part.

Amongst these roots, certaine fine tendrils [Table 15, Fig. 2. Q Q. Table 16, Fig. 1. DDD, Figure 2, aaa] hauing the bodies of Veines, and being gathered into one stumpe or stalke [table 15, Figure 2, a. Table 16, Figure 1, E] are disseminated, which carry the choler from the Liuer to the bladder of gall, which also are ioyned with the rootes of the gate-veine, that the blood before it come into the branches of the Hollow veine, may bee purged and clenfed from that cholericke excrement.

The passage
of Choller to
the bladder of
Gall.

The same substance of the Liuer whereof wee spake before, by compassing about these vessels, strenghtneth them, and warranteth their tender threds from danger; by whom also it receiueh in lieu a proportionable good, for it is nourished by blood laboured in the roots of the Port veine, and out of those small ends powred on euery side into his lap: the remainder which he refuseth, is carried into the roots of the hollow vein, and thence both thrust out, and drawne for nourishment into the whole body.

How the Li-
uer is nour-
shed.

There are a few small Arteries [Table 4, Figure 1 M] from the *Celiac* diffused in his substance (which do appeare more white then the Veines) on the hollow side where the branches of the Gate [table 4, Figure 1 t, and Figure 2, t, table 11. L] veine do ioyne together into their common trunk or stumpe, that they might ventilate and so preserue the naturall heate of the Liuer, wherefore they runne onely through the hollow part; for the embowed part is waisted with the continuall motion of the *Diaphragma*, as with a Fan. They also carry vitall heate, that the heate being doubled, the sanguification might better succeed; and that the Liuer also might not be destitute of the vitall faculty: for in the whole bodye, the Veines and Arteries are in a league and helpe one another: these ministring spirits to the veines, the veines blood to them.

The Arteries
of the Liuer.

It hath two smal Nerues [Table 4, Fig. 2 y, tab. 11 M] from the sixth paire: one from that branch that is sent to the vpper mouth of the stomacke; [Table 15, Fig. 10, table 16, fig. 10] the other from the branch [Table 15, Figure 2 f] which passeth to the roots of the ribbes on the right side; both of them disperfed into his coate, that he might not be altogether like a plant without sense, albeit seruing onely for nourishment it stood in no need of any quick or notable sense, wherefore his Nerues are so very small. Hence it is, that the paines of the Liuer are not acute or sharpe, but obtuse or dull, and grauatiue onely. But the bottome or center of the Liuer is altogether without sense, because of the many motions of the humors therein

The Nerues
of the Liuer.

The vſes of the
Liuer.

Columbus.

The manner of
ſanguification
as Baubines
hath deſcribed
it.

When the
Chymus becoms
meth. *chymus*.

Why there is
no cavity in
the Liuer, but
a web or net
of veſſels.

The naturall
inſtinct of veſ-
ſels.

The vſe of the Liuer is by his affuſed ſubſtance to part and ſeparate the veſſels that they cleaue not together; to ſuſtaine and eſtabliſh them: to cherriſh them with his heate; be-
cauſe in that place their coats are thinner, ſaith *Galen 4. of ſuperpartium* 13. than in any other
part of the creature. For by this helpe, ſanguification which is celebrated in the rootes of
the gate veine, which are in the ſubſtance of the Liuer, is duly adminiſtered: to affoord vnto
them the Naturall Faculty as it were by irradiation, euen as the veſſels of ſeede receiue the
faculty of Seed-making from the Teſticles; as alſo to procreate the Naturall ſpirite, which
ſome denie, but *Archangelus* by many arguments doth eſtabliſh: and laſt of all to preſerue
and maintaine the Nouriſhing Soule as they call it, which is ſeated in euery particular part
of the body.

But becauſe there are many opinions concerning the manner of ſanguification, I haue
heere thought good to ſet downe *Baubines* conceite, as the opinion of a man to whome I
am eſpecially in this worke beholding.

All Aliments as well ſolid as liquid are taken by the mouth and after maſtication or
chewing as there is more or leſſe neede, are ſwallowed into the ſtomacke and there conco-
cted and turned into Chylus. This Chylus, aſteward when the pylorus or lower mouth of
the ſtomacke is opened, is thruſt downe into the guts: and if any part of it eſcaped elabo-
ration before, is there reuiſed and re-concocted. The thin and lawdable part of the Chy-
lus (for the thicke excrements called *Aluinaſeces*, are forced into the great guts) together
with that humour which is as it were a watery excrement, and was engendred in the con-
coction of the ſtomacke, is ſuckt away by certaine branches of the Gate-vein deriued from
his trunk (which is fixed in the hollow part of the Liuer) vnto the ſtomacke, but eſpecially
vnto the guts. Theſe veynes which are called *Vena Meſeraica*, and wee muſt call the Meſe-
raick veines, do attenuate the Chylus which they receyue, prepare it and giue it the fyrſt
rudiment of blood, ſo that now it beginneth to be called *Chymus*, that is, a Humour: which
when it approacheth to the trunk of the Gate-veine, is vnburdened of his thicke part, the
Spleene drawing it away by the Spleenicke branch, as hath bene ſayd in the vſe of the
Spleene.

That which remaineth of this *Chymus* or *Humour*, is conueyed out of the trunk of the
Gate-veine into his rootes which are very many and very ſmall, diſperſed through the hol-
low-part of the Liuer. Their coate alſo is very thin (as is alſo the coats of the veſſels of the
Spleene, the Teſticles and the Paps) that the Sanguifying Faculty might more eaſily inſi-
nuate it ſelf into them from the *Parenchyma* or fleſh of the Liuer, without which the blood
cannot be made profitable for nourishment; and from which thoſe veſſels receiue by irra-
diation the Sanguifying Faculty, as the ſpermatie do the Faculty of Seede-making from
the Teſticles. In theſe veſſels, therefore the *Humour* is changed into blood, for no Chylus
is powred out of the roots of the Gate-veines into the fleſh of the Liuer but *Chymus*.

Now that this *Humour* might be longer reteyned, and paſſing through many alterati-
ons be diuided into as ſmall portions as was poſſible, or rather be perfectly laboured, Na-
ture ordained no ſuch cavity in this place as in the ſtomacke; but of infinite & ſlender bran-
ches of Veines made a texture, net or web wherein the Chymus is better thinned, mitiga-
ted and parted into ſmall portions; that the fleſh of the Liuer on euery ſide compaſſing
his diſſeuered parts, might better worke it into a Maſſe of blood. For if there had bene a
cavity formed in the Liuer, then muſt the Chymus haue had a Canel or pipe for his egreſſe
and regreſſe through which it woulde haue ſalne away crude and not perfectly Sanguified,
and therefore vnfit for the nourishment of the parts.

After the blood is thus abſolued and perfected in the roots of the Gate-veine, they haue
a naturall inſtinct to part with it, partly to powre it into the fleſh of the Liuer for his nou-
riſhment that before did them ſo good an office; partly to vnload their burthen into the
rootes of the Hollow Veine, which are eſpecially diſſeminated through the Conexe or
gibbous and embowed part of the Liuer, which rootes alſo haue an inſtinct or deſire to
draw it into themſelues, and to deliuer it ouer into their boughes and branches (in which it
receyue a farther degree of elaboration) pure and defacated from all excrements, to be
distributed vnto the parts of the body.

The rootes of the Hollow and Gate-veines, although they be hand ouer head as we ſay,
without any precise order diſtributed through the fleſh of the Liuer, yet in manie places
they are ioyned by an Anaſtomofis or inoculation (excepting the branches which ſerue for
the nourishment of the Liuer it ſelfe) as they touch in their paſſage ouerthwart one ano-
ther,

ther, or else the extremities or endes of the gate veines are fastned into the midst of the rootes of the hollow veine; or contrarily the ends of the hollow veines into the midst of the gate veines: for after no other manner but this, can the blood be translated out of the rootes of the gate veine into the rootes of the hollow veine.

Anastomosis
how it com-
meth.

But that the blood might better passe through the narrow & straight passages of the vessels, it is wested by a thin & watery humour which is most like to whay; & therefore is called *serum sanguinis*, we call it commonly the Vrine, a humour which is not fitte for the nourishment of any part, but only mingling it selfe with the blood, it maketh it more thin, and so readier to passe along; wherefore *Hippocrates* called it *ὄχημα τῆς τροφῆς*, *The Wagon of the nourishment*.

The use of the
whay.

And whereas no Aliment is so simple, but that it consisteth of diuers and different parts; we must know, that all those parts cannot be changed into laudable blood; wherefore as in the first concoction celebrated in the stomach and the smal guts, there was a segregation of the excrements of the belly: so in the beginning of the second concoction, which was in the meseraicke veins, there was a segregation made of the crasse & foeculent part of the *Chylus*, from the pure & laudable, which was sent away to the spleene. But in the concoction which is accomplished in the veines of the Liuer, two excrements are separated, least if they remained mingled with the blood, they should be with it transported into the whole body. These through their proper passages are conuayed and stored vp in the peculiar and appropriated receptacles or places of receipt, The first of which, is the bilious or cholerick excrement, which is disposed partly into the bladder of gal, partly sent away into the guts, as we shall say in the next chapter. The second is, the *serous* or whaey humor, the greatest part whereof, when the blood is arriued out of the rootes of the gate veine into the hollow vein, becommeth an offensive burden vnto it; and therefore the Kidneyes by the emulgent veins and arteries draw it out of the hollow veine and the great artery into themselves.

The blood thus cleansed and depured from all manner of excrements, is distributed by the trunks and branches of the hollow veine through the whole body, in which passage it receiueeth an alteration or disposition of nourishment, that no time should be lost. These branches of the hollow veines doe with the blood carry also a part of the aboue mentioned whay or vrine, to make it more fluxible, that it might the better passe through the Capillary veines of the parts to nourish them; where when it is arriued, it is as it were sprinckled vpon the flesh, into which by little and little in manner of a vapour or dewe it soaketh and sinketh, cleauing like glew till it be wholly conuerted into the proper Aliment; which glew by nourishing and restoring, maketh good the Radicall moysture and the substance of the parts. But the whay which accompanied the blood thither in the third concoction, that is, in nourishment which is accomplished in every particular part, as an vnprofitable excrement is exhaled in sweat and insensible transpiration: thus far *Banbinc*.

CHAP. XIII.

Of the Bladder of Gall.

THe Bladder of Gal [Tab. 15. Fig. 1.2. PP] called *vesica biliaria*, or *folliculum felleum*, in greek *χοληδόχος*, is the receptacle of pure choller; and hath his seate in the right and hollow part [tab. 15. BB] of the Liuer, that it may be fitter to receiue the choller, which being a mad and hare-brain'd humour, had neede at the first generation of it be sent away, lest it should set all the body in an vprore; & therefore Nature placed his receptacle in the very bosome of the Liuer; his owne acrimony also hastneth his euacuation. The Liuer therefore hath as it were engraued in it a certaine cavity or bosome, wherein the vpper & middle parts of the Bladder are tyed firmly to it; the lower part in the meane time hanging loose from the body of the liuer, so as it toucheth the right side of the stomach and the *Colon*, dyeth them both oftentimes with a yellow colour; yea further affecteth them with his iuice sweating through his coates; whence it is not vnlike, that the burnings & flaming heates of some mens stomachs doe arise. The Figure of it is [tab. 15. Fig. 2.] long, that it might not be pressed by the stomacke, round also with his length and hollow, which hollownesse by degrees becommeth narrower, till at length it endeth in a necke.

It is small in respect of the spleene and the Kidneyes, albeit it draw a iuice both of a mid-

The situation.

The flaming
heats of some
mens stomachs
whence it
commeth.

The figure.

Why so small.

Table 15. The first Figure sheweth the lower belly wherein the stomacke with the guts are thrust into the left side: the Liver is lift up also, that you may better see the hollow side of the Liver, the bottome of the bladder of gall, the vessels which passe thereunto, and the passage of gall called Porus biliartus, which goeth unto the duodenum, and certain branches beside of the gate veine, together with a part of the mesenteric.

The second Figure sheweth the bladder of gall, his passages and vessels, as commonly Anatomistes make demonstration of them.

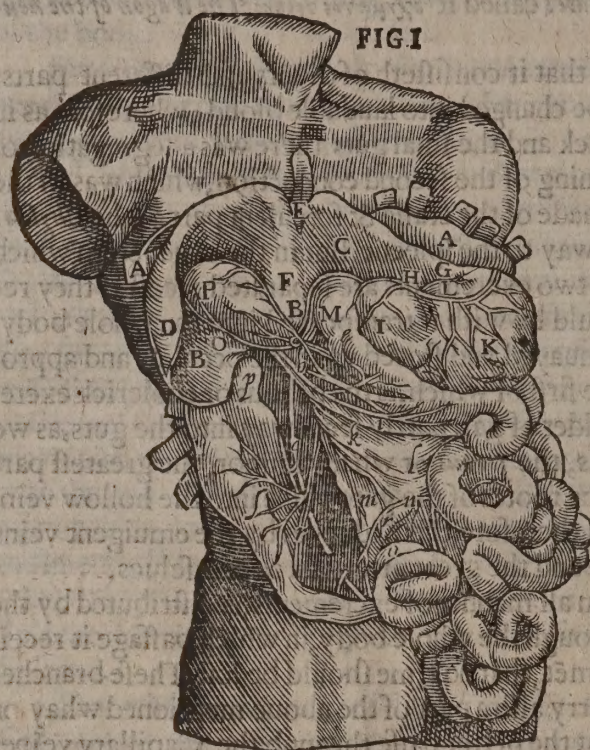


FIG I. Branches from the fore said vessels to the Peritonæum. & 1. The vessell of seed called deferens, or the Leading Vessell.

dle quantity and consistence in respect of the iuyces drawne by them both: but the reason of his smalnes is, because the number of his drawing orifices is both greater & more commodious then those of any other instrument whereby the liver is depurated or purged.

His Substance

The membrane.

The crust of the vesicle.

His substance is membranous, to the end that being full, it might be dilated or stretched, and when it is empty it might fall together againe. For it hath a double membrane; one common from the Peritonæum (Vesalius saith from the coate of the Liver) wanting Fibres wherewith that part onely which hangeth off from the Liver (which onely stands in neede of a defence) is cloathed; and with this coate it is tyed to the cavity or bosome of the Liver. Another proper, thin indeede, but firme and strong and of such a nature that it is not to be hurt or offended by choller, by which other membranes are much affected. Wherefore though it be but single, yet the number is supplied by the strength and fastnes of it; for it hath all kindes of fibres, that the substance might be stronger and fitter for dilatation; the inmost are right, the outward transverse, the middle oblique and those not many. It is within incompassed with a crusty substance ingendred of the excrements of the third concoction of the bladder it selfe, least it should be hurt by the acrimonie and sharpnes of the choler contained therein.

His

His Vessels are: Two slender veins from the trunk of the Gate veins, called *Cystica gemelle*, the twins of the bladder [Tab. 15. fig. 2. gg. Ta. 16. fig. 1. PP] which (as in the white coate of the eye) are distributed for his nourishment. For it is nourished as all other parts of the body with blood not with choller: & by other vessels [tab. 15. fig. 2. Q. Q. Tab. 16. fig. 1. DD. fig. 2. aaa] draweth his proper excrement pure and unmixed, faith *Galen* 5. *usu part.* 7. blended with blood, as doe the Kidneyes.

The arteries it hath are very small, from the Coeliacall artery which ascend [tab. 15. fig. 2. c. Tab. 16. fig. 1. N] vnto the hollownesse of the Liuer, that being (as it were) wrought by their continuall motion, it might be kept from corrupting.

A Nerue it hath, but scarce conspicuous or visible [tab. 15. fig. 2. f. Tab. 16. fig. 1. O] from a little branch of the sixth paire, that creepeth ouer the coate of the Liuer. All these vessels are fastned in the same place at the neck [tab. 15. fig. 2. b. Tab. 16. fig. 1. C] to the body of the bladder, and dispersed into his coate do reach vnto his bottome, [tab. 15. fig. 2. P. Tab. 16. fig. 1. A.]

The first Figure sheweth the Naturall scituation of the bladder of Gall taken out of the Liuer, his fashion and vessels.

The second Figure sheweth the bladder of Gall growing to the Liuer, but opened, that you may see his valves: it also sheweth the *Portus biliaris*, which passeth from the Liuer to the Duodenum.

TAB. XVI.

FIG. I.

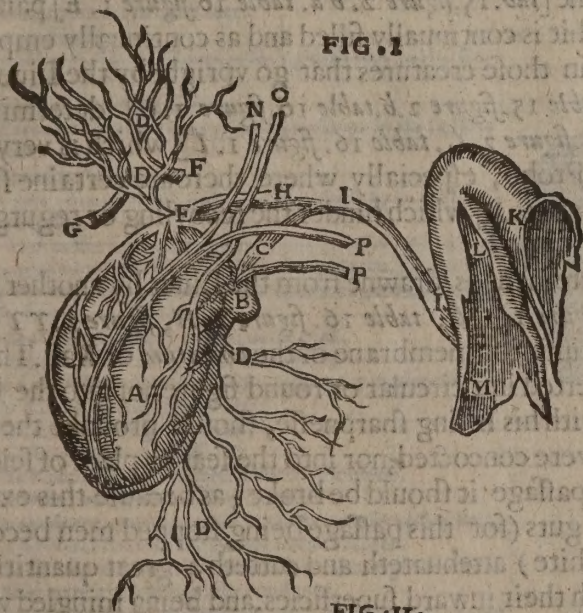
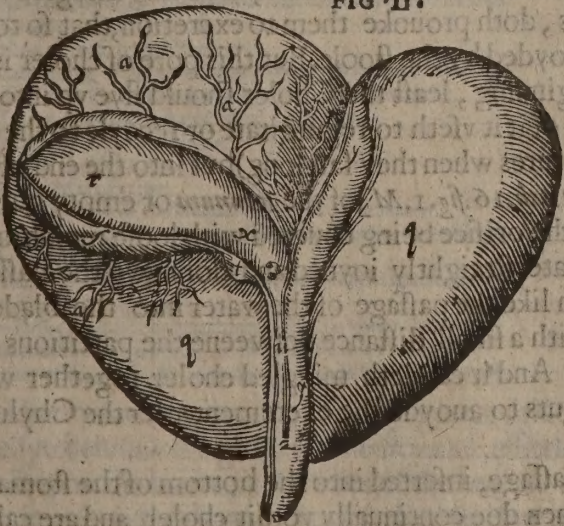


FIG. II.



A I. The bottome of the bladder of Gall, in his naturall scituation.

B I. A bosome or denne at the beginning of the necke of the bladder, at which place within are the valves placed.

C I. The necke of the bladder of gall.

DDDD The holes or passages of the bladder of gall distributed through the substance of the Liuer between the roots of the Gate veine at F. and the hollow veine at G.

E The meeting of the passages afore named.

FG I. The roots of the gate veine at F. the roots of the hollow veine at G. all distributed through the Liuer.

H I. The *Portus biliaris*, whose mouth made of the concourse of the passages marked before with DDD. is wider then the necke of the bladder.

II A common passage or hole (as well of the *portus biliaris* H. as also of the necke of the bladder C.) reaching to the gut *duodenum*.

K I. The right orifice of the stomacke ioyned to the gut.

LM I. The gut *duodenum* opened, that the insertion of the common passage at M. might appeare.

N I. An artery dispersed into the hollow part of the Liuer, and into the bladder of gall.

O I. A small nerue common to the Liuer and his bladder proceeding out of the sixth paire: the cutter hath made it a little too big.

PP I. The veines called *Cystica gemelle*, or the twin veines of the bladder of gall, which are branches of the gate vein deriued to the bladder. They should haue beene made much lesse.

qq 2. The hollow part of the Liuer.

r 2. The bottome of the bladder opened.

s 2. The out side of the bladder of gall.

t 2. The bosome or denne proper to the vesicle or bladder of gall.

u 2. The neck of the bladder.

v 2. Three veines at the necke, sometimes but two.

w 2. The *Portus biliaris* open, which carrieth the thicker choller directly from the Liuer, to the end of the gut *duodenum*.

x 2. The meeting of the necke of the bladder, and of the *Portus Biliaris* into one. aaa 2. Certaine small passages out of the bottome of the bladder, carrying the thinner part of the Choller into the Liuer.

The vessels.
The twin-
Veines.

Arteries.

Nerves.

It is divided into a bottome, a neck, and the passages of choler, which are called *Meatus* or *pori Biliarij*. The bottome is the greatest [table 15. Fig. 1. 2. P. tab 16. Fig. 1. A] part of the bladder, and looketh downward [as appeareth table 16. Fig. 1.] when with the Liuer it remaineth in his naturall seate. It is round, and dyed with the colour of the yellow choller it containeth; sometimes it is blacke, when the choller being long kept in the place is adust or burnt, which also now and then is condensed or hardned into smooth stones of diuers forms, which stopping the lower passages, we haue knowne to breede perpetuall laundises and incurable.

The necke.

The necke is the narrower part [table 16. Figure 2. b] of the bladder, much harder then the bottome, to whose end is set a peculiar bosome or cavity. [Table 16. Figure 1. b. Fig. 2. f.]

The figure.

It is also long, looking vpward, and by degrees ending in a narrow passage [table 16. fig. 1. C] which making a semi-circular Figure, as of a halfe Moone, determineth into the passage of choller, called *Porus* [tab. 16. Fig. 1. H] *Biliaris*, where the common passage is made [table 16. Figure 1. I.]

The passages of it.

The passages of the bladder of gall are double (called *ποροι χοληδόχοι*, because they carry choler) for that the cholericke excrement is two wayes purged out of the liuer, to wit, pure and vnmixed, or mingled and thicke according to *Galen*, 4. *usu part.* 12, and 13. For the vnmixed and pure choler is drawne by small vessels [tab. 15. Fig. 2. 22, tab. 16. fig. 1. DDD, Fig. 2. aaa] sent into the Liuer [tab. 16. fig. 2.] with infinite strings: shed abroad betwene the rootes of the hollow [tab. 15. fig. 2. S. tab. 16. L] and gate veines, [tab. 15. fig. 2. R. tab. 16. fig. 1. F] and at the length ioyned together into one [tab. 15. figure 2. b a. table 16. figure 1. E] passage, and thence powred into the bladder, and it is continually filled and as continually emptied (the bladder being pressed as some say in those creatures that go vpright by the Liuer, in others by the stomacke) by a passage [table 15. figure 2. b. table 16. figure 1. G] determining into the pore or hole of choler, [table 15. figure 2. C. table 16. figure 1. I] which is very fine and threddy, that it will scarce admit a Probe, especially where there are certaine small Membranes about the necke [tab. 16. figure 2. X] which hinder the recoyling or regurgitation of the choler.

The way of the mixed choler.

The thicke and mixed cholericke excrement is drawne from the Liuer by another passage called *Porus Biliaris* [Table 15. Figure 1. 2. C. table 16. figure 1. H, figure 2. Y T] the pore or hole of choler, supported by the inferior membrane of the *omentum* or *Kall*. This is a long vessell, which from the liuer is inserted in a circular or round figure not into the bottome of the stomacke, least the choler with his biting sharpnesse, should prouoke the stomack to put ouer the Chylus before it were concocted, nor into the seat or place of seidge, not so much for feare least in so long a passage it should be broke; as because this excrement being powred forth into the small guts (for this passage being stopped men become full of laundise, and their excrements white) attenuateth and cutteth a great quantitie of Flegme cuer heaped vp in them, scoureth their inward superficies, and being mingled with the excrements gathered in the great guts, doth prouoke them to excretion, that so together with the dry excrements it may be auoyded by the stooles. But this pore of choler is inserted into the small guts, not at their beginning, least the Choler should flye vp into the stomacke (although where there is plenty of it it vseth to regurgitate or recoyle to the stomacke, which is ordinary in cholericke natures when they fast long) but into the end of the *Duodenum* at the entrance [table 15. fig. 2. D. tab. 16. fig. 1. M] of the *teinum* or empty gut betwixt the two coats of the gut, obliquely, the orifice being couered with loose membranes or rather with the foulds of the inmost coate straightly ioyned and closing vp the passage least any thing should returne back, much like the passage of the water into the bladder. Sometimes the pore is parted in twaine, with a small distance betwene the partitions and both of them inserted into the same gut. And it carrieth mingled choler together with more pure, to stirre vp the faculty of the guts to auoyde the excrement after the Chylus is sucked from them.

A third passage not perpetually found

There is also found sometimes a third passage, inserted into the bottom of the stomack, into which it powreth choller; and such men doe continually vomit choler, and are called *πυρροχολοι ἀνω*, that is, purgers of choller vpward, as those men who haue it at the end of the empty gut, are called *πυρροχολοι κάτω*, that is, purgers of choller downward, and these mens stooles are alwayes bilious. The vse of this bladder of gall is to receiue and expell yellow choler

The vse.

choller exactly sincere vnmixt and familiar into it selfe immediately from the Liver and so out of the whole body, which other wise running at randon through all, would defile the spirits, raise a continuall vlcereous sence his acrimony gnawing the flesh and rending the membranes, cause all our motions to be head-strong and giddy, our sensations phrenetick and mad; and beside diuerse other inconueniences would breed a continuall laundise.

CHAP. XIII.

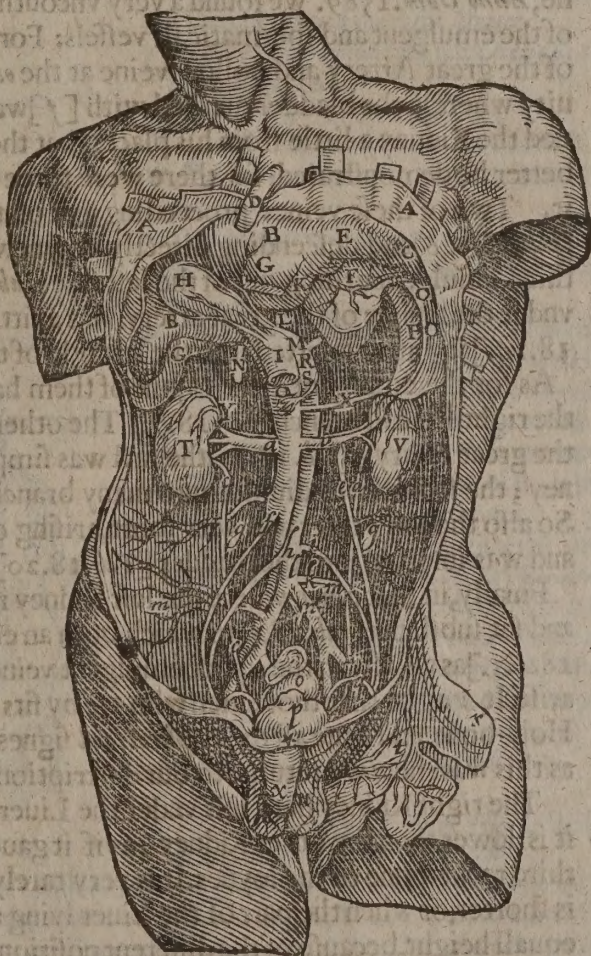
Of the Kidneyes.

THe Kidneyes are called *Renes* of a word which signifieth to flow, because the vrine flows away by them; and *νεφροί* as it were Pissers. All men and foure-footed beasts which beget by generation haue them, but no fowle or fish with scales, saue onely the Torroise, saith *Aristotle* in his 4. book *de partibus animalium*; for their humour is spent into scales and feathers, and beside they drink little because their longues are not so bloody

The lower Belly emptied of the Membranes, Guttes, and Stomacke, together with many of the vessels which are therein.

TABVLA. XVII.

- AA The middriff turned back with the ribs & the *Personau*.
 BB The caue or hollow part of the Liver, for the liver is lifted vppe, that the hollow part of it may be better seene.
 C The left ligament of the Liver.
 D The vmbilicall veine.
 E The hollowesse in the Liver, which giueth way to the stomacke.
 F The left orifice of the stomacke.
 GG Certaine knubs or knots and impressions in the hollow part of the Liver.
 H The bladder of gall.
 I The gate veine cutte off, and branches which go to the bladder of gall.
 K A Nerue of the Liver coming from the stomachicall nerue.
 L An artery common to the Liver and the bladder of gall.
 M A nerue common also to them both, coming from the right *Coffall* nerue of the ribs.
 N The passage of the gall to the guts cut off.
 OO The hollow and forepart of the spleene.
 P The Line where the vessels of the spleene are implanted.
 Q The trunk of the hollow veine.
 R The trunk of the great artery.
 S The *Celiacall* artery cut off.
 T The Kidneyes yet wrapped in their membrane.
 XX The fatty veines called *Vene adiposa*.
 ab The emulgent veines together with the arteries vnder them.
 cc dd The vreter from either kidney to the bladder.
 ef The spermaticall veines to the Testicles, the right from the hollow veine, the left from the emulgent.
 gg Veines coming from the spermaticall veines to the *Peritonaeum*.
 hh The spermaticall arteries.
 i The lower mesentericall artery.
 l The ascending of the great artery aboue the hollow veine, & the diuision of it and the hollow veine into two trunks.
 m The artery of the Loynes, called *Lumbars*.
 n The holy artery called *sacra*.
 o A part of the right gut.
 p The bladder of vrine.
 * The connexion of the bladder, with the *Peritonaeum*.
 q A part of the vessels which leade the seede from the testicles, is here reflected.
 r The *scrotum* or colde, that is, the skin which inuesteth the yarde and the testicles.
 s The fleshy pannicle or membrane which is vnder the *Cod*.
 u The coate which is proper to the testicle with his vessels.
 v A part of the yarde excoriated or slayed, & hanging downe.



as other creatures are. The kidneyes haue seldome the same scite or position in men; and doe lye behinde the guts and the stomack, a little vnder the Liver and Spleene [tab. 17. 60] close vpon the backe, at the sides of the hollow veine and the great artery [tab. 17. Q R] yet not in an equal distance (hauing their hollow parts turned toward one another) that they might more readily draw away the whay, that al the blood that is receiued into the hollow veine, might be presently purged and so carried pure, with a little water onely to west it, into the whole body.

For this watery humour, albe it bee an excrement and no part can be nourished with it, yet

The names.

The scitua.

The vsc of the wh ay.

yet is it very necessary as long as the nourishment is contained in the veins of the mesentery and the Liuer, that by the thinnesse of this humour or whay being made fluxible, it might passe those straight veines, whereupon *Hippocrates* called it *vehiculum alimenti*, or the wester of the nourishment, as before is said. But when the bloud is gotten into the hollow vein, it then needeth not so much helpe, because it is to passe through large and patent passages, and, beside is made of it selfe more fluxible by the heat of the heart and the liuer.

Why placed
one above
another.

Their positio.

An vncouth
forme of the
Kidneyes ob-
serued by *Bau-*
hine. An. 1589

They often stand not one opposite to the other [*Tab. 20. and tab. 2. lib. 4.*] left in their ioynt strife they should hinder one the others attraction, as *Galen* hath conceiued; but we, sayeth *Bauhine*, imagine that the cause of this position is rather to be attributed to the arising of the vessels [*Tab. 20. b.*] and properly of the emulgent or sucking veines, because their attraction is greater and of more vse. They lie with their f. sides vpon the muscles of the loynes which they call *Ios*, appointed for the bending of the leg; about their heads not much lower then the lowest ribs, in those voyde spaces which are betwixt the rootes of the ribs and the hip-bones. They lie betweene the two membranes of the *Peritoneum*, one of which lyeth vnder them, the other vpon them; whence it is that in fits of the stone, the leg on that side where the stone lieth is benumbed, sayeth *Hippocrates*, because of the compression as well of the muscle we spake of before, as of a sinew which descendeth that way.

But before we proceede further in the particular description of the Kidneyes, giue mee leaue to insert a story out of *Bauhine*, wherein he describeth a strange fashion and position of a kydney, with all the vessels thereto belonging; which we haue caused also to be cut in the following Table for thy better satisfaction, gentle Reader. In our publique Anatomy saith he, *Anno Dom. 1589.* we found a very vncouth forme and scituation of a left Kidney, as also of the emulgent and spermaticall vessels: For the Kidney was placed iust vpon the diuision of the great Artery and hollow veine at the *os Sacrum* or holy-bone [*Tab. 18. d e*] in that cavity wherein the bladder marked with [*f*] was scituated; but in the Table we haue removed the Kidney a little from his place, that the implantation of the emulgent vessels might better be demonstrated: for there were three emulgent veines, & two arteries fastned into it. Two of these veines proceeding out of the middest of the trunk of the hollow veine [*tab. 18. 6. 6*] and descending directly downeward, were implanted into the right side. The third emulgent arising out of the left side [*tab. 18. 9.*] of the hollow veine, and descending vnder the trunk of the great artery, was a little mixed with the left spermaticall vein [*tab. 18. 16.*] and after inserted into the left side of the Kidney.

As for the emulgent arteries, one of them had his beginning vnder the bifurcation, out of the right Iliacall branch [*tab. 18. 7.*] The other did arise a little about the bifurcation out of the great artery; [*tab. 18. 8.*] the first was simple and inserted into the right side of the Kidney; the second was diuided into many branches and did insinuate it selfe into the left side. So also the left vreter was very short, arising out of the lower end of the kidney, [*tab. 18. 19*] and was inserted into the bladder [*Tab. 18. 20*].

Finally, in that place where the left Kidney is vsually placed, Nature had set a glandulous and fat substance [*tab. 18. c*] to which both an emulgent veine and artery were disposed [*tab. 18. 4. 5.*] as also from the vpper emulgent veine, the left spermaticall veine [*Tab. 18. 4.*] did arise. It may be that those men who are by fits tormented with grievous paines about the Holy-bone, and haue all the *Nephreticall* signes, haue such a position of one of their kidneys as this was: now we returne to our description.

The seate of
the right kid-
ney.

Of the left.

The true causes
of their diuers
position.

The right Kidney lieth iust vnder the Liuer, and because of his waight in a man [*tab. 18*] it is lower then the other Kidney, as if it gaue place to his better; his end reacheth to the third racke-bone of the loynes. It is very rarely higher then the left, and then onely when it is shorter, or when the part of the Liuer lying next it, is hollowed: they are also rarely of an equall height, because of the different position and quantity of the Liuer and Spleene; some also adde because of the higher or lower beginning of the emulgent vessels.

On the left side, the Kidney lyeth vnder the Spleene, and is often (yet not alwayes) higher then the other, because there the Spleene is thin and slender; so that the Kidney ascendeth sometimes to the first racke-bone of the loynes, sometimes to the 11. of the breast, yet neuer is one so farre above the other, that the middle of the higher doth reach about the top of the lower. But in brute beasts because of their groueling gate, and because their Spleen reacheth further downeward, the scituation of the Kidneyes is contrary, so that in Dogges there is a hollownesse or bosome made in the Liuer (which in a man hath neither hollownesse nor diuision) that the right Kidney might ascend higher. Indeepe the true causes of their

The first
minory vessel
Kidney, as
The second
Testicles.
The third
and their
scituation



H. The porous or
round part of the
backe part of the
testicle vessels. O.
covered with his
innate coat of the
middle. VV. The
artery

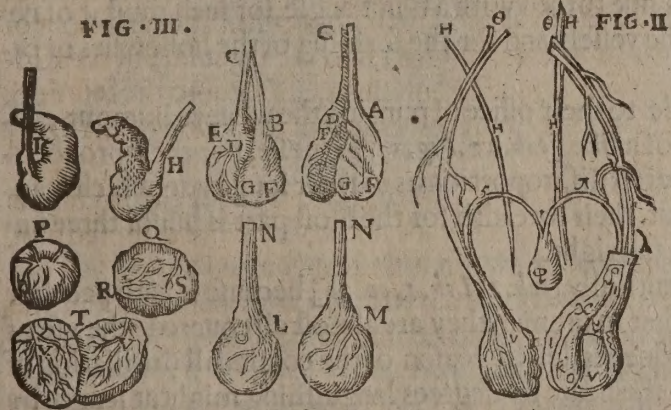
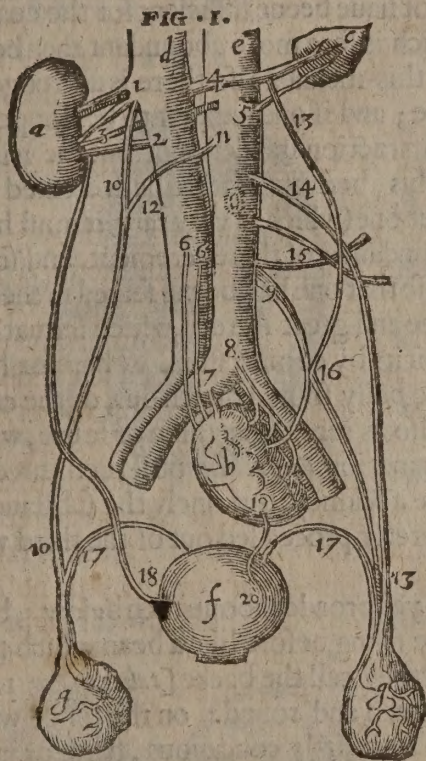
their diuers
of the vessels, an
an external Mem

The first Figure sheweth the disport of Nature in the seminary vessels, the emulgent, and the position of the left Kidney, as we meet with it in a publicke Dissection.

The second Figure sheweth the seminary vessels, with the Testicles.

The third Figure sheweth the diuers formes of the testicles,
and their severall parts.

TABVLA XVIII.



ab. The right Kidney *a.* the left *b.*

c A glandulous and fatty substance, which was in the
roome of the left kidney.

d e The hollow veine *d*. the great artery *e*.

f The bladder of urine.

g. g. The testicles.

1,2 A double right emulgent veine, the first of which
hath a double originall.

3 The right emulgent artery.

4 The left emulgent veine,

5 The left emulgent artery.

6,6 Two emulgent veins at the left kidney.

7,8 The emulgent arteries vnder the bifurcation or di-
uision at the left kidney.

9 The fourth left emulgent veine.

10,10 The right spermatike veine.

11, 12 The originall of the spermaticke artery 11. his
coniunction with the veine 12.

13 The left spermaticke veine.

14 The left spermaticke artery.

15 A veine going from the left spermaticke veine to the
Peritonæum, accompanied with an artery.

16 The union of the left spermaticke veine, with the emulgent veine. 17 The leading vessels.

18 The insertion of the right Ureter.

19, 20 The originall of the left Ureter at 19. and his im-
plantation at 20.

Figure 2. *xxxx* The Ureters.

00 The spermaticke veines and arteries.

II The coate of the testicle which ariseth from the *P*
eritonæum.

♣ The spermatick vein and artery, as they passe into the production of the *Peritonæum*, and as they passe againe out of it.

μ The bodden body called *corpus varicosum*, or the wonderfull implication of the veine and artery.

The left Testicle covered with the inmost coat.

ξξ The revolution of the leading vessels.

op The ascent of the leading vessel unto the share bone.

τ ς The reflection or returning of the leading vessels to the backe side of the share bones,

τφ The coirion or meeting to gither, & insertion of those vessels into the glandules called *Prostate* at φ.

Figure 3. AB The forepart of the right testicle.

C C D The spermaticke veine and artery cut off where they fall out of the *Peritoneum*, and C sheweth the beginning of the bodden body, called *corpus varicosum*, and D sheweth his *basis* or foundation.

E The passage of the leading vessell.

F His reflection.

G A portion of the leading vessell climbing vpward,
with his departure from the testicle.

H, The porous or spongy face of the leading vessell or *Epidymis*, where it groweth to the coat of the testicle. *I*, The gibbous or round part of the same vessell, where it groweth not vnto the foresaid coat. *L*, The fore part of the testicle. *M*, The backe part of the same, together with his inmost coate, and the boddē body. *NN*, The first commixtion of the spermatike vessels. *OO*, The *basis* of the spiry boddē body and his insertion into the inmost coate of the testicle. *P*, The testicle couered with his iamost coate, shewing the vpper part into which the boddē or varicous body was inserted. *QRS*, The inmost coate of the testicle, drawne from the testicle at *R*, but couering the testicle at *S*. *T*, The testicle cut through the midst. *VV*, The distribution of the vessels through his substance.

their diuerse scituation, are the different magnitude of the kidneyes, the different length of the vessels, and their position either more or lesse oblique. They are knit by the help of an externall Membrane arising from the Rim (which like a ligament stayeth them firme-^{Their connexion.}

ly in their proper places) to the loyns, the *Diaphragma*, and the right to the blind gut, sometimes to the liuer; the left to the *Colon* (whence it is that nephreticall paines, that is, inflammations or other paines of the Kidneyes, become more grievous by reason of abundance of wind or excrements, and the collicke is often hardly distinguished from the paines of the Kidneyes) and to the spleene.

Their fibres.

Beside the membrane aboue named, they haue also other fibres from the *Peritoneum* inserted into their gibbous part, which are happely those *Hippocrates* calleth Nerues, in his Booke *de natura ossium*. They are also tyed by the emulgent vessels to the hollow veine and the great Artery [tab. 17. ab, table 2. Lib. 4. m n, tab. 22. bi.] Finally to the bladder it selfe by the vreters or passages of vrine, of which we shall heare more by and by [table 17. p c d, table 22. m n e.]

Why two.

The Kidneyes are two, because one would not haue beene sufficient for the euacuating of so great a quantity of waterish excrement, which is fare more abundant then both the excrementitious chollers, yellow and blacke. By this meanes also there is a stronger attraction of serous blood, and both sides draw alike; and if one happen to be stopped with the stone or grauell or ought else, yet the work of attraction standeth not, but the vrine is auoided; (although *Archangelus* will not yeelde to this, because Nature hath created nothing against casualties,) whereas if there should be but one (which is very rare) it must haue beene of necessity as big as both, because of the abundance of this excrement, and so the body should not haue beene equally ballanced, vnlesse that one had beene seated in the very midst of the backe, iust vpon the hollow veine and great Artery, which scituation would haue hindered the free descent of blood and spirits by compression. Wherefor Nature for one greater made two smaller, that neither the belly should bunch out, or the creature incline and hang too much to either side. It is also as rare to see three or foure, which when it hapneth they keepe not their ordinary conformation. *Eustachius* obserued three together, the right was naturall, the left had nothing like a Kidney, but onely the substance of a triangular forme, and wanting an vreter, for the vreter proceeded out of the third which was almost foure square.

The figure.

The Figure of the Kidney is long and broad, yet broader aboue then below; before and behinde pressed somewhat flat, yet a little more rising before like a bean which thereupon we call a Kidney beane. On the outside (which they call the backe [tab. 22. Fig. 1. c.] of the Kidney) toward the flankes gibbous or embowed and round: on the inside where they looke toward the hollow veine, partly gibbous and partly concavous, flatte or sadled, and as it were crooked into the forme of a line turned with a blunt angle, for such must it of necessity be, both for the admission of the vessels, and for the forming of the hollownes or caviities therein.

The magnitude of the kidneyes.

Their magnitude is proportionable to their office of purging the whaeye humour, although for the most part they are not of a like [tab. 22. Fig. 1.] bignesse, nor their proportion answerable to the body; yet the greatest disproportion is in their longitude, which commonly equalleth foure rack-bones, but their breadth for the most part is but of three fingers, and the left is often shorter then the right.

The fat of the kidneyes.

About the kidneyes cleaueth fat plentifully [tab. 2. Lib. 4. oo pp] because it hath peculiar vessels by which it is nourished; so that in fat men they are almost all couered: the vse of which is to cherish the heate of the Kidneyes, lest by reason of the continuall distillation of so great quantity of the vrine or whay, the heate by degrees languishing might at length be extinguished, and so all their action faile; and beside, lest the vessels should be endangered by distention; wherefore in a man it is on the inner side of the Kidney layd as a soft bed or couch betweene the membrane compassing about the distribution of the vessels and the branches of the vreters: in a Dogge betwixt the membrane which formeth the saddle side of the Kidney; besides, this fat with his smooth and slippery moysture dulleth the acrimony of the whay or vrine.

The vse of it.

There cleaueth to both the Kidneyes in the vpper part, where it regardeth the hollow veine, a glandule or kernell, the inuention or finding whereof is due to *Eustachius*, which sticketh fast to their outward membranes, so that oftentimes if a man take not heede in the taking out of the Kidneyes, he shall leaue it hanging to the Membrane of the *Diaphragma*. This glandule somewhat answereth in substance and figure to the Kidneyes themselues, yet is often more flat and liker to a cake then to a kidney; as long it is as two fingers, as broad as one, of a moderate thicknesse; but they are not alwayes of an equall greatnes, but most

The glandule of the kidney.

com-

commonly the right is the larger. Among the new writers (some say) there are manie of them, but will not haue them to be found in euery body, but to bee engendred when the matter is too plentifull; but how soeuer we haue the things, yet hitherto we want their vse or at least the knowledge thereof.

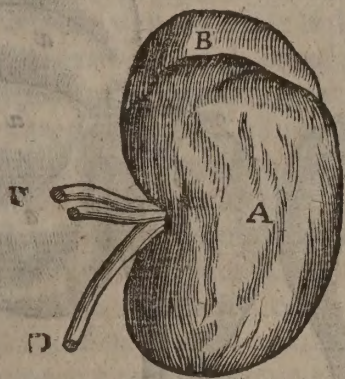
The vse of these Glandules not yet knowne.

To this Glandule there is sometime sent a certaine Tendril from the hollow veine neere the Liuer, sometimes it taketh it from the Veine which we call *Adiposa*, which goeth to the fat of the Kidneyes to nourish it, of which wee spake euen now: sometimes it hath both Veines.

Table 19. sheweth the Kidney of a man. The first figure the whole Kidney; with the Glandule set a-boue it. The second Figure sheweth the Kidney Dissected, that you may see the inward face of it.

TABVLA XIX.

FIG. I



A 1. The Kidney of a man whole.

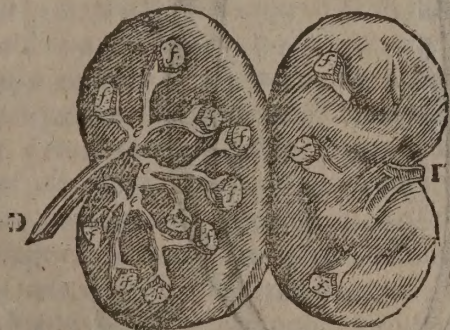
B 1, The Glandule placed vpon the Kidney.

C 1, The emulgent veine and Artery.

D 1, 2. The Vreter.

ccc 2. The Vreter open, and how it parteth it selfe into the substance of the Kidneyes, as it were with many pipes.

FIG. II.



fff 2. Caruncles or teats, with very fine perforations, which opening into the foresaide pipes of the Vreter, doe as it were through a fine strainer passe the Vrine into them, to bee conueyed to the bladder.

The Kidnies are couered with a double Membrane, one outward arising from the *Peritoneum* neere the lower part of the *Diaphragma*, where it is knit vnto the *Peritoneum*: this cleaueth not very straightly to them [tab. 2. lib. 4. OO, PP] but they are as it were wrapped in it, whence it is called *fascia renum*, that is, the Kidneyes swathing band. This Membrane receyeth the *vena adiposa*, [table 17. XT, table 2. lib. 4. lb] and is rowled in plentifull fat, and so serueth the Kidneyes instead of a couering, of a tye, and of a soft pillow or bolster.

The Membranes.

The other Membrane which is proper to the Kidnies is very thin, and produced out of the common coate that compasseth the vessels (but dilated) and growes to them exceeding strongly, so that it maketh their flesh otherwise of it selfe firme, yet more fast and compact, And although it make the outside glib and shining, yet it wanteth fat, neyther is it wouen with any vessels. This accompanieth the vessels, bent inward it pierceth into their hollownesse, and compassing them round about, makes them more strong.

The substance of the Kidnies [table 21. Figure 2] is a hard flesh most like the heart, fauouring that it wanteth fibres, which yet the threds of the veines do supply. Fast and compact that the inherent heate may more strongly and easily draw the vrine that is so neere (for to draw an excrement from farre, a loose and lax instrument is more meete) and expell it; and againe, leaue the blood which is their nourishment should slippe away with the vrine, which would come to passe if their flesh had beene immoderately loose, whereas now it is

Their substance.

fitly

fitly reteyned, and hath time to bee diffused all ouer their substance. But on eyther side at the hollownesse [Table 22, e e] where the emulgent vessels are divided into greater braunches, their substance is but loose and vnequall, and is on the inside perforated with passages running through it from the vreters, where are obserued certaine parts rising somewhat from the flesh, which in their substance, figure and office do imitate the nature of glandules or kernels, whence some of the ancients haue esteemed these parts of the kidneyes to bee Glandules. Without, his superficies or face is like the Liuer smooth and glib: his colour duskish in a mans health, and not much vnlike a red Beane (seldome very red) and shining. It is also very rare that a mans kidneyes should be outwardly vnequal, and made as it were of many kidneyes or small glandules like the Liuer of a Beare or Oxe, yet *Eustathius* found

TABVLA XXI.

Fig. 1. sheweth the fore side of the right Kidney.

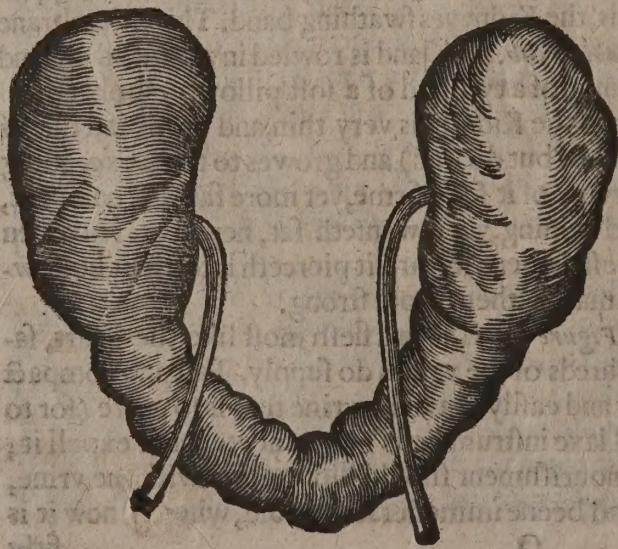
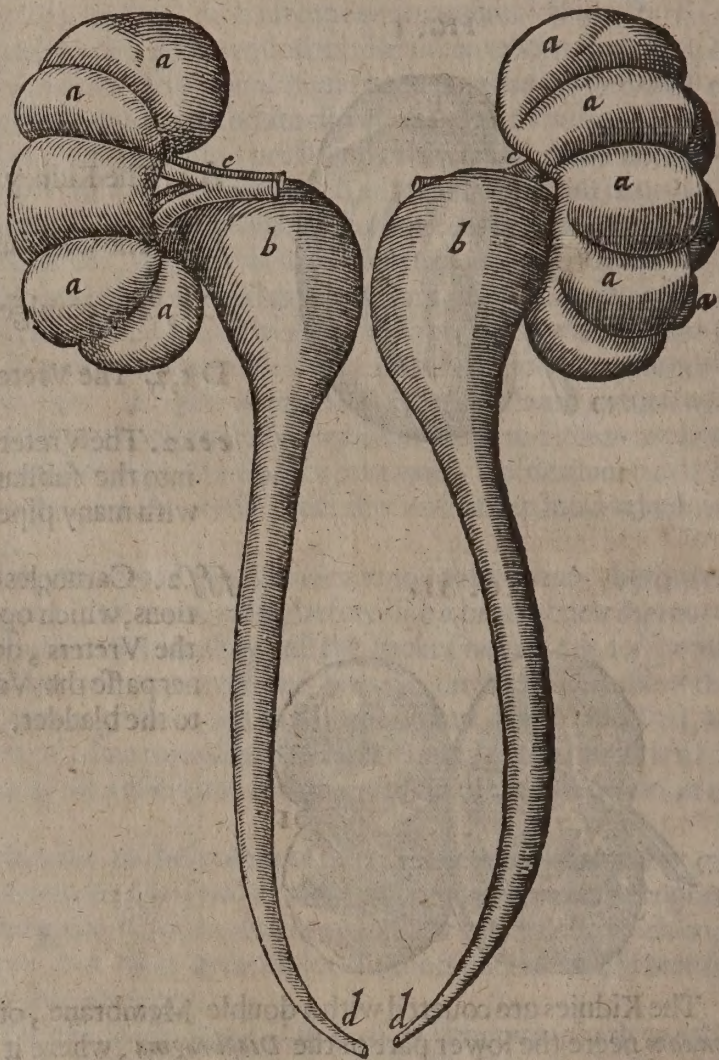
Fig. 2. sheweth the back side.

- a The body of the Kidney, consisting of eight lobes or partitions.
- b The Vreter distended with Vrine.
- c The emulgent vessels.
- d The lower part of the Vreter, far narrower then it vseth to be.

This Table sheweth the figure of a Childs Kidney, which died the fourth day after it was borne, in the Hospitall of *Argentine*. The child was opened by Doctor *Iohannes Rodolphus Saltzmanus*. He did indeede sucke, but auoided nothing either by stoole or Vrine. His guts were full of winde, but his Fundament was not perforated. His kidneyes were by lines distinguished into eight parts. His vreters wel stretched with water, but at the bladder they were so smal that a smal probe could hardly without violence be entred into them, which being stuffed with slime, did stop the descent of the Vrine, so that in the bladder, there was nothing but a little of that slime: the kidneyes were somewhat like the kidneyes of an Ox.

FIG. I.

FIG. II.



It shall not be impertinent also, to annex this strange forme of the kidneyes which *Bauhine* receiued from that excellent Philosopher and Physitian, D: *Leonard Doldius*, the ordinary Physitian of the City of *Norinberge*. This kinde of Kidnie and Vreters was obserued in the body of *Andrew Helme* of *Weissenfeld*, who dyed at *Norinberge*, the 17. of October, in the yeare of our Redemption, 1602. and the sixteenth of his life, hauing lyen long hurt of a blow he receyued in his belly about the groyne.

such

such in two Infants, a Maide of a 11. yeares of age, and a Man at Rome. The forme of a kidney of that kind discovered in a young Childe by Doctor *Saltzmanus*, and by him sent vnto *Basilius*, we haue here a little before annexed.

They haue two *venters* or cauities, the outward and inward: the outward improperly so called [Table 22. d] which *Fallopian* calleth the Gate, is in the saddle side, where the kidney being like a bent bow returned at either end, it is most what diuided into three parts. The first is a bunch or prominence like a smal hillocke, at either end of which there is a bosome or cauity ending in another prominence before you come to their gibbous part. Into the corners of these bosomes the diuided vessells [Table 22. l b] doe offer themselves, thence to be dispersed into the substance of the kidneyes, one branch into the vpper angle of one bosome, another into the lower angle of the other, out of which also the *ureter* proceedeth.

The cauities
of the kidney.

The vessells which are sent vnto the kidneyes are of all sorts, Veines, Arteries & Nerues. The Veines proceede out of the hollow veine one of them [table 17. x r] is that fatty vein whereof we haue spoken, and it is double; one on the right hand, and another on the left: The right issueth very rarely out of the trunk of the hollow veine, but most what out of the emulgent; the left alwayes out of the hollow veine, and is diuersly distributed to his vtter coate to water or bedew the same; sometimes also it offers a little branch to the glandule which we spake of adioyned to the kidney, which when it hath perforated it is againe consumed in this coate of the kidney.

The vessells,
Veines
Vena adiposa.

The other veine, of his office is called the emulgent or sucker [table 17. a b, table 22. h i] most commonly one on each side; for in the framing of these vessells Nature often diuersly disports her selfe, so that they differ oftentimes not onely in seuerall bodies, but euen in the same. This Emulgent is a notable vessell, and the greatest of all that arise out of the hollow veine; not that the Kidneyes stand in neede of so great store of nourishment, but that the serous blood may haue a free and expedite passage. It ariseth seldom directly out of the trunk of the hollow vein, but is carried with an oblique but short progresse downward, and being parted into 2. branches, is inserted into the saddle side of the Kidney, carrying thither the serous or watery blood out of the hollow veine. In these emulgents wee haue obserued certaine valves or floud-gates which hinder the recourse of the whay or vaine into the hollow veine. With these is vnited a branch one or two of the veine *sine pari* or without his fellow, (of which we shall entreate more fitly in another place) that there might be a consent betweene the Kidneyes and the breast.

The Emulgent
veines.

Why the Emulgent
is so great.
Whence the
Emulgent arises.
The values of
the Emulgents.

Arteries it hath of each side one [table 17. vnder a b, table 22. vnder h i, table 18. character 3, 5.] from the trunk of the great Arterie; great emulgents or suckers also, which do purge waterish moysture (plentifully containd in the Arteries) from the blood, and withall doe allow heate to overcome the cold of the Kidneyes, which *Galen* sayth they acquire by the passage of the watery moysture through them.

The arteries
of the kidneyes.

Their use.

These vessells first parted into two, do then get into the cauities of the Reynes and are presently diuided, commonly into foure braunches, and so are disseminated diuersly into the whole substance of the Kidneyes [table 21. Figure 1, G G] till at length they are so by degrees seuered by manifold partitions, that they become as small as hayres: then they approach vnto the Caruncles which are *spongy* peeces of flesh, through which the whay is filtered or streyned.

The Kidneyes needed no other third veine differing from these whereby they should be nourished, because they doe not draw a pure excrement as the bladders doe, which therefore needed particular veines to carry their nourishment; but these vessells being full of blood as well as of whay, doe nourish the kidneyes with the blood, and send away the whay to be auoyded. They haue nerues on either side from the stomachicall branch of the sixth paire (whence comes the great consent betweene the stomacke and the kidneyes, and the subuersion of the stomacke, and frequent vomits in Nephriticall passions or diseases of the kidneyes) which descend downward to the rootes of the spondelles or racke-bones of the loynes; and are distributed into the proper membrane of the kidneyes. Moreouer from about the originall of the Arteries of the mesenterie, there doe proceede a fewe tendrils of sinewes mingled together; part of which goe vnto the kidneyes and the glandules that lye vpon them, the other part together with the emulgent Arteries doe insinuate themselves into the hollownesse of the kidney, and are distributed through their substance. Hence it is that Nephriticall patients haue not onely a certaine dull sence of paine, but also most vehement

Why the kidneyes
haue no particular
veins to nourish them.
The nerues of
the kidneyes.

hement torments in their kidneyes; not onely therefore because their holes or denues, as *Galen* sayth, are not wide but narrow, & the kidneyes because of the firmenes of their substance cannot be stretched as the bladder may, but especially because of these nerves distributed through their substance; notwithstanding the paine of the stone is greater when it entreth into the vreter, both because of his exquisite sence, as also because of the straightnes of the passage through which the stone falling, must needs teare it almost with stretching, which paine wee see not alwayes to follow those whose passages are dilated by the often coming downe of stones.

The inner
venter of the
kidneys,

The inner venter or cauitie of the kidney, hath a hollownesse made of a sinewey membrane which the emulgent vesselles doe not produce, for they determine into exceeding hairy threds; but the vreters, which becomming first broad in the hollownesse [table 21. Figure 1. F] of the kidneyes are the matter of it. At whose side on either part before the vessells are diuided into lesse branches, the substance of the kidneyes appeareth loose and vnequall (the Anatomists call it *Cavernosa, spongi-formis, erosa*) when the fat that compasseth it about is diligently removed.

The Vreters,

The vreters are diuided into great branches, first double or treble (as in the next chapter shall appeare) and then into many others, not (after the manner of other vesselles) still lessened into hairie threds, but broad in the end (so that a man may obserue eight or ten branches like canels or pipes) that they may better receiue the Caruncles before spoken of. For those Caruncles which are like small glandules in the endes of all the vessells (and of a paler colour because they are of a harder flesh then the rest of the kidney) being produced out of the substance of the kidney, and somewhat sharpe like vnto the nipples of breasts, insinuating themselues into the said vessells in manner of a couer or stopple, doe stoppe them vp; which if they be cut according to their length, a man may obserue in them certain furrowes and tunnelles as small as hayres. Wherefore, being so finely bored that they will scarcely admit a haire; by them the whay or serous humour coloured with choler, is separated from the blood, and is insensiblie percolated or drayned into the pipes of the vreters or membranous tunnels (this is called the *Colatorie*) and gathered together in that common hollownesse, and thence is sent downward by vreters into the bladder: it may bee these furrowie passages are hollowed in the substance of the kidney like as the holes in the nipples of the breasts. And these spongie Caruncles had neede to be so finely bored, least the blood which together with the vrine and choler is drawne by the emulgents but for their proper nourishment, should with them also passe away into the bladder (which we see sometimes to happen and that without paine; when either the separating or reteyning vertues of the kidneyes are decayed or those small passages widened) considering that this separation is made not by concoction where Nature is her owne chooser, but by transfusion; although wee doe not deny but that these excrements do here receiue a kinde of elaboration though not a concoction.

The colatorie

The separation of the
whay is by
transfusion
not by concoction.

How the kidneys are nourished.

This blood thus remayning behind, is as it were sucked by the flesh of the kidneyes, and is sprinkled vpon it like a kinde of dew; from whence by degrees after the manner of a vapour it is scattered into his whole body, cleaueth, is vnited to it, and finally becommeth the nourishment of the kidneyes. But because being so thin it nourisheth but slenderly, it is continually and in great quantity drawne in, together with much vrine, which (the blood remaining behinde) insensiblie droppeth through those Caruncles.

The triall of
the truth in
this discourse
of the passage
of the vrine.

These things, although they differ from the common opinion of some others yet, may they fitly be demonstrated if you put a Probe into the vessells as they enter in, and the vreter as it goeth out, and then make incision at the saddle side of the kidney; and yet much better and more elegantly are these passages shewed, if you separate the flesh of the kidney from his vessells; which separation hath abundantly satisfied vs in this point: and therefore we haue exhibited it in the 21. Table and the first Figure.

But because these things doe not so appeare in Dogs as we haue now saide, and yet young Students for want of Mens bodies are often faine to dissect the kidneyes of Dogs: wee thought it not amisse, here briefly to insert the description of Dogs kidneyes also.

The structure therefore of a Dogges kidney delineated in the second Figure of this 21. Table is on this manuer.

The description
of a dogs
kidney.

The membrane immediately couering the kidney entreth into his cauity where it is reflected or returned and on both sides spread abroad, like as is the membranous bodie from which the Vreters do proceede. To this Membrane cleaueth the fat whereupon the dis-

stri-

Fig. 1. sheweth the vessels of the Kidneyes separated from the flesh. Fig. 2. sheweth the Kidnies Dissected according unto Vesalius. The first is the Kidney cut according to the length through the gibbous part, so as the slit reacheth unto the second sinus or cavity of it, no part of the kidney taken away. The second exhibiteth the Kidney where all the substance or partition which is called Septum renis is sliced away in a compasse, that the second cavity may better appeare.

The third sheweth all the branches of the first cavity or sinus, the flesh of the Kidney being quite taken away. Fig. 3. expresth the devise of some men concerning the percolation or streyning of the whey; the first sheweth the Kidney dissected from the gibbous part toward the Hollow part, together with the Cribrum or Sine, the second sheweth the middle part of the Kidney.

TABVLA XXI.



FIG: I.



FIG: II.

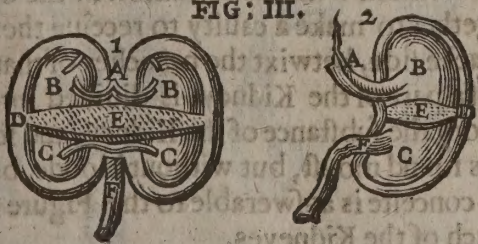


FIG: III.

A. The trunk of the Hollow veine.
B The trunk of the great artery.
CC The emulgent veine diuided into two.
DD The double emulgent artery.
E. The spermatieall veine arising from the trunk of the hollow veine.
F The latitude of the Vreter in the bodye of the kidney; in the broader part whereof oftentimes are engendred, ragged and branched stones.

Fig. 2. $\alpha\beta$ 1, 2. The forepart and hinder part of the kidney.

$\gamma\gamma$, 1, 2. The orificies of the branches of the first sinus or cavity of the kidneyes.

$\delta\delta$, 1. The body of the first sinus into which the veine and the artery of the kidney do determine.

$\epsilon\epsilon$ 1, 2. The hole where the Vreter begins.

$\zeta\zeta$ 1, 2. A part of the Vreter.

$\eta\eta$ 2. The circle between α and β , shewes the second Sinus of the kidney.

$\theta\theta$ 2. The backe part of this sinus is marked with η , the forepart with θ .

Fig. 3. The emulgent veine and artery.

B B. The sinus or cauitie into which the vrine is streyned out of the first cavity.

CC. The cavity into which some think the vessels do powre the serous or wheay blood,

DD. The substance of the kidney compassing this cavity round about.

EE. The Drain of the Kidney called Colatorium, or the Membrane perforated like a sieve, through which the vrine passeth say some, together with the Choler that coloreth it out of the cavity marked with B, into the cavity marked with C.

FF. The Vreter which receyueh the vrine out of the second Cavity, and leadeth it into the bladder.

distribution of the emulgents into the Kidnies doth leane, as vppon a pillow or boulder for their security. It hath also many holes through which the vessels enter into the Kidneyes. Next followeth that which is called *The membranous body*, which is diuided into manie branches and as a couer compasseth the vessels, it maketh a cavity which conteyneth the vessels and the fat.

Vpon this *Membranous body* lyeth the cavity of the Kidney, in the middest whereof hangeth a part of the substance of the Kidney regarding the gibbous side, differing in colour from the rest, and wanting the Membranous couer before named. It is like a new Moone, and hangeth like a partition, so leaning vpon the *Membranous body*, that the cavities of the same Kidney seemeth to be double. But in the Kidney of a man there are no such cavities to be found, but the emulgent vessels and the Vreters are diuided through his substance into many branches, and the cavities which are in the Kidneyes are wrought as it were out of them.

The vse of the
Kidneyes.

The vse of the Kidneyes is to draw from the whole masse of bloode, as well that of the Veines, as that of the Arteries, the serous humour through the emulgent vessels by a proper attractive faculty arising from the similitude of substance betweene it and the kidnies, and so to purge both kinds of the blood, arteriall and venall from that excrement. For those parts which through large orificies do draw their conuenient and familiar iuice, cannot draw it pure, simple and sincere, but with the admixtion of some other of a diuers kind. Wherefore together with the Vrine is drawne both much moyst and thin blood out of the Liuer, and much yellow choler, which the bladder of Gall did not attract before. But the Vrine or whey by the force of the kidneyes is segregated from the blood in the very concoction of their Aliment, & beside their attractive faculty gathereth the blood into their substance for the nourishment of it: but the Vrine as an vnprofitable excrement, the expelling vertue straineth through the furrowes or tunnels of the Caruncles (thorough which also the grauell passeth from the body of the Kidney together with the Vrine) into the membranous pipes of the Vreters: which vrine is gathered together in the greater hollownesse of the Vreters, and from them is sent into the bladder, where againe it is kept a certaine time, and at length is expelled thence at our discretion through the Yard, the Sphincter. Muscle being relaxed or loosened. The choler also passeth along with the vrine, from whence it hath his yellow tincture: for when the choler gaddeth vpward to the braine (as in phrenies it is not very rare) then are the vrines very pale.

How the v-
rines are colo-
red yellow w.

The common
opinion of the
way of the
vrine before
Vesalius time

Before *Vesalius* time it was a common receiued opinion, and reteyned yet by some, that in the Kidneyes there are two bosomes or cavities running according to their length; one higher, another lower, which are distinguished by a transuerse or ouerthwart Membrane perforated like a Siue which they call *Renis colatorium*; and that the emulgents did powre serous blood into the vpper cavity, and thence the choler and the vrine did passe through the fine searcing holes of the Membrane into the lower bosome; the blood remaining behinde because of his thicknesse. Out of the lower cavity yssueth the Vreter, which receyueh the streyned vrine, and conuaiteth it into the bladder. The manner of which deduction of the vrine we haue expressed in the third *Figure* of the 21. *Table*. Thus.

Vesalius opi-
nion.

The emulgent vessels which powre the serous blood into the first cavity at *A*. which is strained through *E*. into the lower cavity *C*. and then receiued by the Vreter which is marked with *F*. Afterward *Vesalius* (who counselleth to Dissect either a Dogges Kidneyes or a Goats, fearing to deale with a mans because of the fat) and almost all before *Fallopins*, were of opinion, that the Kidneyes had two cavities, the one wouen of the extremities or ends of the emulgents which passe into the kidnies. This texture is hollow like a Vessell, and is distributed through the body of the Kidney, and at length diuided into a forepart & a backe part, each of which produceth fixe, seauen, or more thick branches equally distant one from another, yet so that the fore-most are vnited with the hindmost in the out side where they make a circle, and so do agree together to make a cavity to receiue the serous blood. The other bosome or cavity is on the backe side, betwixt the branches of that *membranous body*. And this by the interposition of a part of the Kidney, is diuided into two parts, where it receyueh the whey distilling from the substance of the Kidney, and fendeth it into the Vreters. This cavity in Dissection is found moyst, but without bloode, but the former is alwayes found full of blood, and this conceite is answerable to the *Figure* of the Dogs kidneyes. [*Tab. 21, Fig. 2*] And thus much of the Kidneyes.

CHAP.



CHAP. XV.

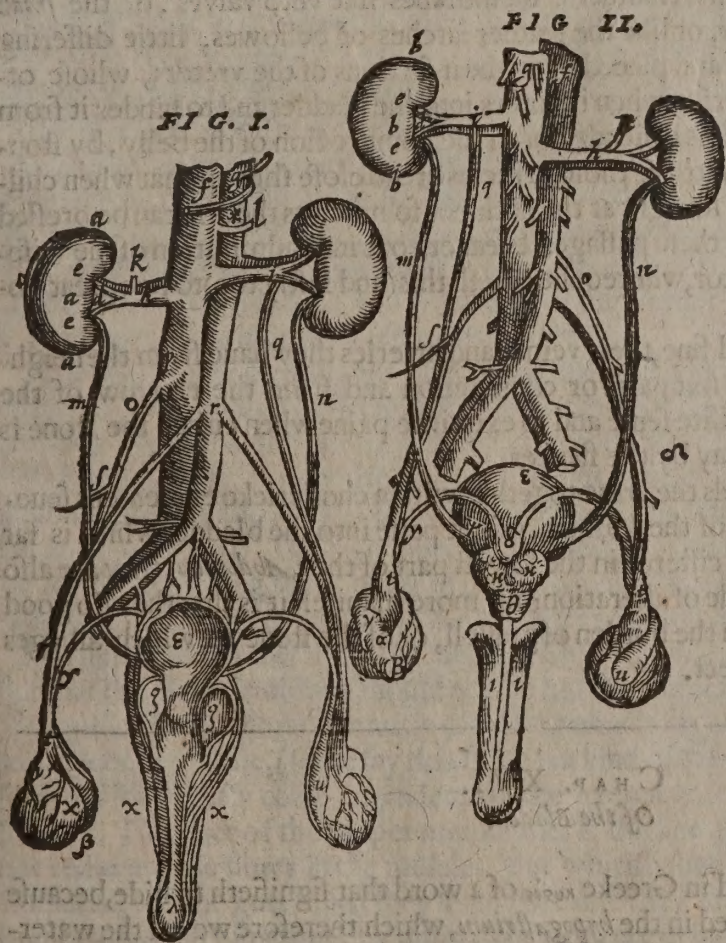
Of the Vreters or passages of urine.

THE Vreters or urine leaders or vessels of Urine, the Greekes call *uplūpas*, as a man should say the pissers. *Hippocrates de Glandulis* calleth them *oxetis* or conduit pipes. They are two vessels [Table 27, c. d. Table 2. lib. 4. qq. Tab. 22. mm] on cyther side one (sometimes, but seldome two or more, yet meeting in one before their insertion) which lying vpon the Muscles of the Loynes, and a little inflected or turned inward to make an oblique passage, doe descend betwixt the two Membranes of the *Peritoneum* or *rimme* of the belly vnto which they are knit, and soare ioyned to the bladder. [Table 22. f. Table 16, char. 18, 20.]

Their figure is round, a palme; long and of the bredth of a straw; in those that are much troubled with the stone dilated to the proportion of a chickens gut; hollow and running aside or obliquely like the letter *f*. In women larger then in men, but right and short, and hence it is that they auoide stones with much lesse pain then men. Their substance is properly white (whence some call them the *white veines*) without blood thicke and neruous, (whereupon other men call them *neruosi canaliculi* or the neruous Tunnels) which makes them so strong.

Table 22. sheweth the Kidneyes with the vessels of urine and of seede; a part of the Hollow veine and of the great Arterie, the Testicles, the bladder, and the yard. The first figure sheweth the fore-side, the second the hinder side.

TABVLA. XXII.



- aaa 1. The forpart of the right kidney.
 bbb 2. The back part of the left kidney.
 c 1. The outward side.
 dd 1, 2. The inner side.
 ee 1, 2. The two cavities whereinto the emulgent vessels are inserted.
 ff 1, 2. The trunke of the Hollow veine.
 gg 1, 2. The trunk of the great artery.
 hh 1, 2. The emulgent veine & artery.
 ii 1, 2. The right fatty veine.
 j 1, 2. The left fatty veine.
 k 1. The Celiacall artery.
 mm 1, 2. The vreters.
 opp 1, 2. The right spermatick veine which ariseth neere p, the left neere q.
 r 1, 2. The place where the arteries of the seede do arise.
 s 1, 2. Small branches distributed from the spermaticall veines to the *Peritoneum*.
 t 1, 2. The spiry bodden bodie, called *Varicosum vas pyramidale*.
 u 1, 2. The *Parastata* or *Epididymis*.
 x 1, 2. The testicle couered yet in his coate.
 y 1, 2. The place where the leading vessell called *Vas deferens* doth arise.
 z 1, 2. The descent of the same leading vessell.
 a 1, 2. The reuolution of the same leading vessell.
 b 1, 2. The passage of the same vessell reflected like a re-current nerue.
 c 2. The meeting of the same leading vessels.
 d 1, 2. The bladder of Urine, the first figure sheweth it open, the second sheweth the back parts.
 e 1. The small bladders of seede opened.
 f 1, 2. The Glandules called *glandula prostatica*.
 g 2. The sphincter Muscle of the bladder.
 h 1, 2. The two bodies which make the substance of the yard.
 i 1, 2. The vessels which go vnto the yard, and the necke of the bladder.
 j 1. The passage which is common to the vrine and the seede, cut open.
 k. The implantation of the vreters into the bladder.

The Vreters.

Their course.

Figure.

Substance.

This

Hip. de na. offi.
Arist. 3. Hist.
Animal. 4.
Gal. 6. Epid.
Com. 5. lib. 4.
The proper
coate of the
veffels
Their diuani-
cation in the
kidneyes.

This kinde of substance is found in no other part of the bodie vnlesse it be in the bladder, to whose inward substance they are verie like, and to which they are continuat; by reason of which substance, & beside, because they may not be seuered frō the bladder without breaking (whereas they may from the kidneyes whole and sound) it may be lawfull to say, that they haue their original from the bladder, although our great Ancients, *Hippocrates*, *Aristotle* and *Galen* haue taught otherwise, namely, that they arise from the Cautie of the kidneyes. This substance, gifted with oblique fibres for distinction sake, if any man will say is the proper and peculiar coate of the vessel, which a common membrane doth inuest, giuen him for further strength from the *peritonaeum*, we will not gaine say him.

But these vreters after they haue incompassed [Table 21. Fig. 1.] the inward venter or cautie of the kidnie and made 8. or 10. pipes, they passe out at the saddle side, or if you will rather say thus, when the vreter is gone into the kidnie (of a man not of a dog) becomming somewhat broader, it is diuided into three branches like the emulgents, and is distributed into the vpper, the lower, and the middle region of the kidnie, of which the vpper and lower are againe subdiuided each of them into 3. and the middle into two; these being short and large haue broad ends, wherein euerie one of them receiue the glandule which we said was like the nipple of a womans breast, arising out of the flesh of the kidneyes in the manner of a fleshie stopple, that so through them the vrine might be streined into euery one of the pipes or runnels. Often times many of these braunches are perforated in the middle likewise, where in their vtter mouthes they receiue a glandule also.

Their implan-
tation into
the bladder.

The reason of
this implanta-
tion.

They are implanted into the backward and lowest part [tab. 22. 4.] of the bladder (for their implantation could not be more commodious because the bladder cleaueth to the right gut) not farre from the neck betwixt his two proper membranes hauing the distance of two fingers betweene them, and so with an oblique insertion they pierce the cautie of the bladder, but their passage or entrance is very narrow; by which kind of insertion the returne of the vrine toward the kidneyes againe is foreletted. Some ascribe this hinderance of the reflux of the vrine to certaine transuerse membranes like vnto valves, or the *small membranes of chaffe or husks of corne*, or like the leather latches of bellows, little differing from the substance of the bladder and placed vpon the insertions of the vreters, whose office also it is to giue place to the vrine when it flowes into the bladder and to hinder it from returning, either when the bladder is distended or in the compression of the belly, by stopping the orifices of the vreters; and trulie those orificies are so close shut vp, that when childre blow a hogs bladder and tie it freight at the neck, not so much as the aire can be pressed out. Wherefore *Galen* speaking of these passages, breaketh out into admiration of the wisdom and providence of our Creator, whereof he taketh this (and iustly too) to be a great document or argument.

In 6. Epid.
Com. 5. lib. 4.

Their vessels.

Their vessels are very hairie and fine, their veines and arteries they haue from the neighbor parts. Their nerues from the sixt paire or coniugation and from the marrow of the loynes, whence comes their exquisite sense and so exquisite paine when either the stone is in the head of them or passeth away by the flanks.

The vse of the
vreters.

Their vse is, that in their channels the vrine together with a chollericke excrement seuered from the blood by the power of the kidneyes, might passe into the bladder which is far distant from them and placed as a cisterne in the lowest part of the *Abdomen*, they are also thought to giue to the vrine a kinde of alteration, but more manifest it is that they do good seruice in freeing the kidneyes from the burden of grauell, or of the stone to which all ages and sexes are very prone and subiect.

CHAP. XVI. Of the Blader.

The bladder.

The bladder of vrine called in Greeke *κυσίς*, of a word that signifieth to hide, because it hideth the vrine, is seated in the *hypogastrium*, which therefore we cal the water-course, in that hollownes [Table 6. lib. 2. H. Tab. 2. g. tab. 2. lib. 4. Y.] which is made by the holy bone, the hip bones & the share bones meeting together, all which cautie is taken vp by the bladder (for it is a large cistern or vessell) and the right gut, close to which the necke of the bladder lieth connected or fastened. In women the bladder lieth betweene the womb [ta. 6. li. 4. T. sheweth the bladder, L. the womb, but ta. 27. of this booke shewes the bladder & the

The scituatiō.

p the womb] & the share bone, as wel because the draining vessels for the excrements of aliment are most conveniently placed in the lower parts for their easier euacuation, as also because of the entrails serving for nourishment, that those which are the most noble might have the vpper place. These bones also are ordained for defence of a part so verie necessarie, and of so exquisite sense, albeit the cavity which they make, was made for other vses, of which wee shall heare more hereafter. His seate is betweene the two coates of the *Peritonaeum* which make as it were a particular *venter* (whence haply it was that *Diocles* diuided the bodie into the head, the chest, the belly, and the bladder) vnder the Sharebone when it is empty; and in Dissection it can scarcely bee found at the first view, for it exceedeth not the greatnes of a reasonable peare, but when it is full it is stretched out into the hollownesse of the very belly, and may be felt about the groine.

Between the
two coates of
the *Peritonaeum*.
Diocles.

The bottome and the fore-part are tyed to the *Peritonaeum*, [table 6, Lib. 2, I. table 2.*] but loosely by two ties. The first is a Ligament [table 6, Lib. 2, b. table 2, I. table 23. Fig. 7. 8. 22.] originally arising from [table 23. Fig. 7. 8. Q.] his bottome and carried to the navill, [table 23. Fig. 7. 8. r.] which they call *Frachus* in the infant. And this ligament is fastened to the middle of the bladder. The other tie is of two vmbilical [tab. 6, lib. 2. a d, tab. 2. k l, tab. 23. Fig. 7. 8. x.] arteries dried, that when a man goes vpright, it might not fall vpon his owne necke and so hinder his excretion. In dogges the bottome of it groweth not to the *Peritonaeum*, but hangeth by a certaine proesse, moreouer in them it is very white, smoth at the bottome and slipperie, as it is also on the inside [tab. 22. Fig. 1. e.] and lined ouer with a phlegmatike humour.

The connection.

His figure is long, a little round, [tab. 22. fig. 3, 7, 8. fig. 2, e, 14. 23. Q.] which some haue likened to a sphere, some to a gourd; for if it were round as a bowle is round, it would be too much pressed by the parts that lie about it. It is hollow that it might receiue a great quantitie of liquor & from a large bottom by degrees growing narrower it endeth in a streight neck; wherfore the parts of the bladder, are two, the body and the necke. The substance of it is partly membranous or neruous, both for the more commodious extension because it is often to be filled & to containe the vrine, that we might not always be constrained, but within conuenient time to yeeld it forth; and also for his corrugation or knitting vp together after euacuation; Partly also the substance is fleshie. It hath three membranes, one common and two proper. The common is the vtter and is from the *Peritonaeum*, a strong and thicke one wherewith it is couered ouer and strengthened, that though it be distended with abundance of water it should not be broken or rent: by this also it is tyed in men to the right gut, and in women to the necke [Tab. 27. f, is the necke of the bladder annexed vnto the necke of the wombe about the priuities at u; tab. 8. lib. 4. Fig. 1. o. the neck of the bladder, and Fig. 3. e. the necke of the bladder, and d the neck of the wombe] of the matrix or wombe, and to the bones of the hippes which are next vnto it.

The figure.

The parts of
the bladder.
The substance

The membranes 3.
One common

The two proper membranes ioyned together are now thicker now thinner, as they are distended or angustated or streightned; but in the vppermost part of the bottome and about the necke because of the insertion of the vreters they are harder and thicker. The inner of these is transparent, very white, thinne, neruous, wouen exceeding thicke with all kind of neruous fibres, as also are all other membranes which stand in neede to be much distended and contracted. The right fibres are inmost, the transuerse outmost, the oblique in the middle according to the order of the functions, that is to say, of attraction, retention & expulsion; which were ordayned for the better conteyning and expelling of the vrine.

Two proper.

The fibres of
the inner
membrane.

This inner membrane (if the bladder be a little blowne) may be separated from the vtter. But that this fine membrane should not be hurt by the acrimonie of the vrine, because it is of exquisite sense, the inner cauitie of his bottome is rugous and full of folds and plights, and mucous or slimie, (some say this slime is a kind of *Fibrous* substance) or rather it is defended with a crusty coate engendered of the excrements of the third concoction of the bladder. The vtter of the proper membranes is thicker sprinkled with fleshy fibres, yet not red as are the fibres in the muscles, but whitish such as appeare in the coates of the stomacke, and the guts: such they seeme because they are placed betweene white membranes: although sometimes by affluxio or affluence of blood they become rednesse so conspicuous, that a man would say it were a fleshy membrane.

The vse of the
fibres.

It hath these fibres as well for the preseruacion of the heate which otherwise would bee very weake; as to keepe also the vrine from falling by the fibres of the inner membranes much distended in repletion: so that these fibres being contracted or drawn toward their

their originall by like little Muscles; by strengthening the bladder (which by the helpe of these fibres knits it selfe together) makes it more able to exclude or shut out euen the least thinges conteyned therein.

The passage.

It hath three holes or perforated passages, two in the backward and lower part a little before it end in the necke, where is the insertion of the Vreters [Tab. 22. Figure 1, 4, Tab. 8, Fig. 1, H] betwixt the two proper coates, by which the Vrine driven downe from the kidneyes, is of it owne accord powred into it, not by resudation or sweating through, but by open passages, [Tab. 8. lib. 4. fig. 1 M] To which (that the Vrine might not recoile or flow backe, no nor the very winde when the bladder is distended) beside the oblique insertion

Tab. 23. demonstrateth the Muscles of the yard, of the Fundament and of the Bladder, and the three bodies of the yard.

The first and second Figures shew the yard excoriated, cleaning yet to the bottome of the share bone.

The third sheweth the same separated with his Vessels.

The fourth and fifth, the yarde cut away, and Dissected overthwart.

The sixth, the Canell or pipe of the yarde divided at the entrance into the bladder.

The seauenth, the fore-part of the bladder and the yarde, together with the umbilicall vessels.

The eight figure sheweth the bladder of a woman with the umbilicall vessels, and a part of the vreters.

The ninth sheweth the backe parts of the bodies of the yarde.

AB, 1, 2, 3, 4, 5, 7, 9. The two bodies that make the yarde.

CC, 2, 3. The place where these two bodies do arise.

D, 1, 2, 3, 4, 5, 7, 9. The nut of the Yarde, called glans Penis.

EE, 4, 5. The fungous and red substance of the bodies of the yarde.

F, 4, 5. The mutual connexion of the bodies of the yarde, and the nervous outward substance of the same, compassing round about the former fungous substance.

G, 1, 2, 4, 5, 7, 9. The passage of the vrine, or the common pipe running vnder the yarde all along his length.

HI, 1, 2. The first paire of Muscles of the yarde which in the first figure doe yet grow to it, but in the second they hang from their originall.

K, L, 1, 2. The second paire of the Muscles of the yarde; in the first figure growing to, in the second hanging from their insertion.

M, 1, 2. The sphincker of the right gut.

N, 3, 7, 8, 9. The round sphincker muscle of the bladder.

OO. A Membrane which is ouer the holes of the share bone.

P 2. A round Ligament from the Coxæ vnto the head of the thigh.

Q, 3, 7, 8. The body of the bladder.

R, 3, 7. The Prestate into which the seede when it is perfectly laboured is led.

S S, 3, 8. Portions of the vreters.

TT 3. Portions of the vessels which leade downe the seede.

VV, 7, 8. The umbilicall Arteries.

X 7, 8. The Ligament of the bladder called Vraclus.

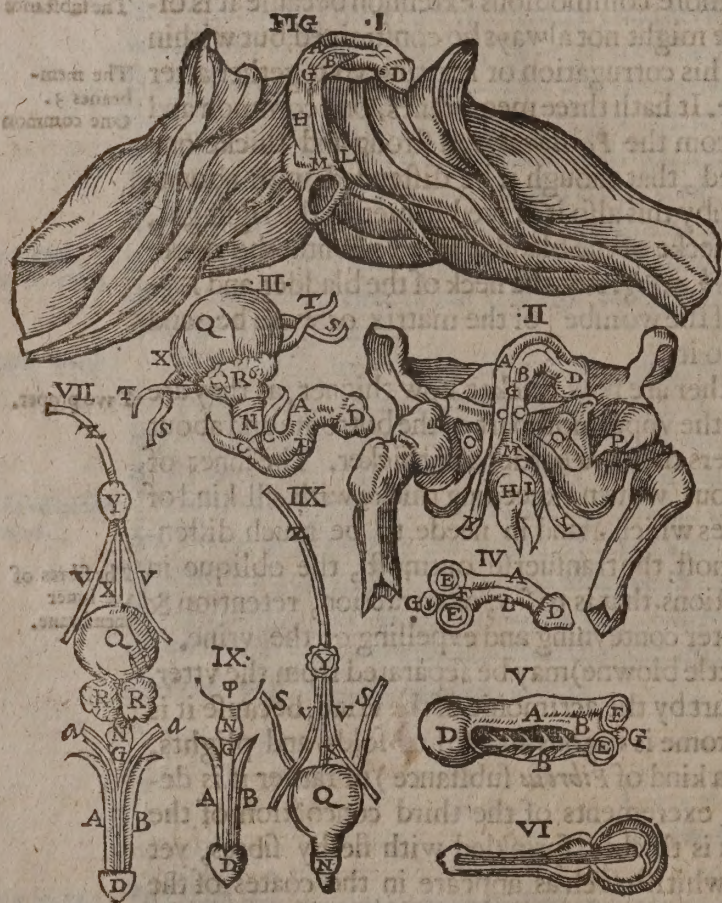
Y 7, 8. The nauell or umbilicus.

Z, 7, 8. The umbilicall veine.

aa 7. The veine and artery of the yarde.

bb 5. The Artery distributed through the body of the yarde.

TABVLA XXIII.



of the Vreters, there is set on either side a smal Membrane or valve, after the maner of the leather latches of Bellowes; but this is an improper acception of a Valve.

The outlet of the bladder.

The third passage or the outlet of the bladder, yeeldeth way vnto the vrine, and is in the necke which is long enough, but straight, conueyed vnder the Share bones, and placed vnder the substances or bodies of the Yarde, and therefore a little crooked, and is carried

ed vpward from the Fundament vnto the beginning of the virile Member, to make his pipe or hollow Canell, and common passage.

In women this outlet is shorter [Table 23, fig. 8. about N] and broader [Table 27. 1] carried right downward, and is inserted into the necke of the Matrixe at the vtter and vpper end. Through this passage women auoide their vrine; men both their vrine and their feede, therefore men haue behind it [Tab. 22. Fig. 2, nm, table 23, Fig: 3, 7, R] two Glandules placed, called by *Galen prostate*, thicke and white, receyuing the insertion of the Vessels, which leade the feede called *vasa deferentia*. Gal. 16. v. 11
part. Cap. 9.

The necke of the bladder is most what fleshy wouen with many Fibres, some right vnder which lye hid transuerse also, which are placed at the beginning of this necke about the faide Glandules, and do contract it so, that the Vrine cannot drop out against our willes in any compression of the *Abdomen*, and strong retention of the breath; wherefore from the vse it is called the *Sphincter Muscle*, and from the Figure of the Greeke Letter *sigma*. *figmoides*. These Fibres being loosened not without a voluntary and strong compression of the Muscles of the *Abdomen* and *Diaphragma*, the vrine eyther by his quantity or quality and acrimony prouoking the bladder, is with contention or strife puffed forth: for if the vrine runne against our will, and without feeling, it is because the Muscle is either paralyticall, or too much cooled. But if this compression of the vpper parts againe do cease, the Fibres are contracted, and so the drops or remainders that continue yet in the passage are expelled. The necke of
the bladder.

The Sphincter
of the blad-
der.

If any man would see this transuerse Muscle lying betweene the right Fibres of the vtter coate and adioyned to the body of the glandules, hee must boyle the bladder lightly, or as we say parboyle it.

Furthermore below the glandules there are to be seen certaine transuerse fibres encompassing [Table 22. Figure 20, Tab. 23. Figure 3, 7, 8, 9. N] the canale or passage which Anatomists haue hitherto shewed for the sphincter. But if these were so, then seede coulde neuer passe without the vrine, as it hapneth in the *Gonorrhoea* or running of the Reines: for in the accompanying of a man with a woman, the muscle in this part must needs bee dilated, which being so, the vrine together with the seede must needs fall away, as it commeth to passe in them that want the vpper sphincter or the vse of it.

His vessels are veines, arteries, and sinewes; the veines and arteries are on both hands at the sides of the necke that they might not be carried farre without a conuoy, and might bee also safely inserted; and are doubly diuided; one part of them is distributed into the whole bladder with many small threds. The other part which is the greater in man because of the yarde, and the lesser in women, is carried downward according to the descent of the necke. The veines serue for his nutrition, for it is not nourished with vrine, neither doth it as the Kidneyes receiue any portion of blood with the vrine, but onely the pure excrement, and therefore stands in need of proper veines for his nourishment. The arteries serue for the recreation and refreshment of the life and heate: both of them proceede from the doubly diuided *Hypogastricall* braunch [Table 8. u u] of the hollow veine and great Arterie: wherefore in the inflammation of the bladder the inner ankle veine is to be opened, but in women they arise from the vessels which come vnto the necke of the Matrix. The vessels of
the bladder.
Veines.

Arteries.

A good obser-
uation.

It hath notable Nerues from the branches of the sixt coniugation which reach to the rootes of the ribs and from the marrow of the holy-bone, that the sence of excretion might bee stirred vp at those thinges which molest it; whence also come those exceeding sharpe paines that a man suffers when it is vlcerated, or but raw. Nerues.

His vse is to receiue like a bottle not only the vrine, which is the excrement of the moist Aliment, by degrees strayned through the Kidneyes and brought downe by the vreters; but also all dry excrements of which the stone is ingendered; which excrements the bladder doth not draw downe, but they are partly put downe by the kidneyes, partly they fall with their owne waight and of their owne accord, whence some call it the vrinall of the body. It also by constriction of the passage keepeth the water till a fit time of excretion, which it doth by a faculty mixed, that is partly Naturall and partly Animall, but the retention belongeth more properly to the Animall faculty, and the expulsion or excretion to the Naturall. The vse of
the bladder.

CHAP. XVII.
Of the Fundament.3. muscles of
the Funda-
ment.
1. Sphincter.

NExt to the Bladder lyeth the Fundament called in Latin *Podex* and *anus*, in Greeke *πρωκτος και ἀρχή*. It is the end of the right gut [Tab. 6. Fig. 2, 3, a] and hath belonging to it three muscles.

The first is called the Sphincter [Table 24. Figure 1. E] a round muscle (whence it is called also the *Ring*) compassing about the end of the right gut to hinder the exiture of the excrements: for it shutteth the passage so close that not so much as any winde can get out. This affordeth a beginning [Tab. 23. Fig. 1. 2. M] to the muscles [Tab. 23. Fig. 1, H I] of the yarde. The other two muscles are called *Leuatores ani* [Table 6. Fig. 2, 3, b c. Tab. 24. fig. 1. BC]

The first Figure sheweth a part of the right gut, with his Muscles cut from the body, which part when we take away the guts, wee vse to leane.

TABVLA XXIII.

A. A part of the right gut,
about which a string is tyed.

B C. Two Muscles drawing
vp the fundament after
excretion.

D. A Musculous substance
which groweth to the
roote of the yarde, but in
women it ioineth to the
very lower part of their
lap.

E. The Sphincter or round
Muscle of the Fundament.



2, 3. *Leuatores*, the lifters of the fundament. They are inserted into the vtter coate of the gut, and into the vpper part of the spincter, [Tab. 24. Fig. 1. E] and grow also to the roote of the yarde and the necke of the wombe. [Tab. 24. Fig. 1. D] Their vse is after excretion to retract the Fundament, and if they be weakned, men are constrained to vse their fingers to doe that office; but because we shall speake more of these muscles in another place; this at this time shall bee sufficient.

CHAP. XVIII.

The muscles and Nerves situated in the cavitie of the lower Belly.

BEside the Muscles of the *Abdomen* mentioned and but mentioned in the ninth Chapter of the second Booke, and the muscles of the Fundament named in the former Chapter, there are also other muscles appearing in the lower belly when the parts aboue named are moued. And those are two paires lying vpon the spondels or rack-bones. The first is the sixt muscle moouing the thigh or the first of his *benders*; they are called in Greeke *ΐσας*, in Latine *Lumbales*. The second is the seauenth mouing the thigh or the second of his *benders*, and it is called *Iliacus internus* the inward flanke Muscle, of which wee shall heare more in the history of the muscles of the thigh.

Lumbales.
Iliacus inter-
nus.Latissimus.
Quadratus.
Obturator in-
ternus.

At the sides of the loynes on either hand is a portion of the broad muscle called *Latissimus*, which draweth the arme backward and downeward, vnder which lyeth the square muscle called *Quadratus*, which is the first muscle of the back. But in the very denne or cavitie it selfe is the muscle of the thigh, according to *Vesalius*, called *obturator internus*, and it

is

is the second mus-
There are also
from the sixt pair
the entalles there
story yet their pr
sinews there are
the Loynes and th
holy-bone alway

He Bones
they com
yet are th
On the backe part
Of the loynes t
with Cartilages
of the Chest, below
Loyne racks is call
led *Acra*, that is

The first Figure
Belly. The second Fig
shew one of the fine
part the fourth the



is the second muscle of those that turne the thigh about.

There are also two sorts of nerues disperfed through the lower belly. Some proceeding from the fixt paire of the marrow of the braine, from which are distributed branches to all the entralles therein contained, of which wee haue spoken particularly in the particular history, yet their production and continuation shall be better insisted vpon afterward. Other sinews there are arising from the marrow of the back, as it is contained in the rack-bones of the Loynes and the holy-bone; Of the loynes sometimes foure sometimes five paire, of the holy-bone alwayes five paire, of which we shall entreate in their proper place.

The nerues of the lower belly
2. kinds of the loynes of the Holy-bone.
Of the loynes 4. or 5. paire.
Of the Holy-bone 5. paire.

CHAP. XIX.

The bones of the lower Belly.

THe Bones which together with the fleshy parts doe make the lower belly, although they compasse not the belly round about as the other two Regions are compassed, yet are there some of them on his backe part, some on his sides, and some before. On the backe part are the rack-bones of the Loynes, the holy-bone, and the Rump.

Of the loynes there are five rack-bones [tab. 25. fig. 1, 2. from b to c] which are knit together with Cartilages and thicke ligaments, and aboue are tyed with the spondels [tab. 25. fig. 2. a] of the Chest, below they rest vpon the Holy-bone. [table 25. figure 1, 2. c.] The first of these Loyne racks is called *uerrigins* from the Kidneyes, which leane vpon it, the last some haue called *ασφαλινς*, that is, the Vnder-propper.

The bones on the back part.
Lumborum Vertebra.
uerrigins
ασφαλινς.
Their processes

The first Figure sheweth the fore-part of the Bones of the lower Belly. The second Figure, the back part. The third fourth and fifth shew one of the five rack-bones of the Loynes, the third the fore-part, the fourth the backe-part and the fifth the side.

They haue ascendet processes [table 25. fig. 4, 5.] descendent [table 25. fig. 4. N] & transuerse [table 25. fig. 2. cc, fig. 3, 4, 5. H] the sharp end of which they call the spine [table 25. fig. 3, 4, 5. CD.]

The Spine.

TABVLA XXV.



The Holy-bone called *ισχον* & *πλατυ*, that is, the broad bone is made of six spondles [tab. 25. Fig. 2. from c to d, tab. 26. Fig. 6. from A to F.]

Os sacrum.

The Rump bone called *κορυνη*, or *os Coccygis* [tab. 25. fig. 1, 2. d, tab. 26. fig. 8, 9.] consisteth of three or foure bones [table 26. fig. 6, 7. from G to K] & two griffles; one, where it is ioyned to the Holy-bone [tab. 26. fig. 6, 7. a] the other at his end or beak, [tab. 26. fig. 7. e] sometimes also betweene his first and second bone.

Os Coccygis.

At the sides of the lower belly there are two bones, whose vpper and broader parts, committed to the Holy-bone, [tab. 26. fig. 13. AB, CC, DD,] are called *ossa Ilium* [tab. 25. fig. 1. mm, tab. 26. fig. 13. above T as f.] the hanch bones, and their circumference is called *Spina ossis Ilii*. [tab. 25. fig. 1, 2. ii, tab. 26. 13. HLMN.] The lower and vtter parts of these bones are called

The bones on the sides.

Ossa Ilium.

Ossa

The sixt Figure sheweth the fore-part of the Holy-bone, together with the rumpe-bone. The seventh figure the back part. The eight the rumpe of a man. The 9. the rumpe of a woman. The 10. and 11. the fore-part and back-part of the holy and rumpe bones of an Ape. The 12. the foreside, the 13. the inside, the 14. the outside of the great haunchbone, the 15. the gristle betwixt the share bones of a man, the 16. the same in a woman.

TABVLA XXVI.

FIG. VI.

VII.



Os pubis.

Os ilii.

ossa Coxendicis [tab. 25. fig. 1. nn. tab. 26. fig. 13. below T and fronto R & p] or the hippe bone, which hath in it a notable boxe or cup [tab. 26. fig. 12. 14. abe] wherein to the head of the thigh is copulated.

Finally the bones in the fore-part of the lower belly are called ossa pubis, [tab. 25. fig. 1, 2. pp. Tab. 26. fig. 13, 14. that which is below R and p] the share bones; they are tyed together in the middest of the share with a Cartilage [tab. 26. fig. 15.] they are very thunne, and haue the greatest perforation of the whole body. [Ta. 25. fig. 1, 2. qq. Tab. 26. fig. 12, 13, 14. q] These bones, together with the Holy bone, make that pelvis or Dish which containeth part of the guts, the bladder & the womb, marked in the 25. Table and in the first figure.

Of all which, we haue heere given you but a view, referuig the fuller Discourse vnto our Booke of Bones.

CHAP. XX.

Of the Breasts or Paps.

The reason why the Discourse of the breasts is here placed.

Their Names.

What creatures haue breasts.

The situation.

AL though the breasts or paps are not contained in the lower venter or compas of the Abdomen, yet as before the Gullet, so now these, because they bee parts which serue chiefly for nourishment, we haue thought this place fittest for their history. But because there is nothing so much vse of them in men as in women, therefore wee will first intreat of the breasts or paps of women, and then of men.

The Breasts therefore are called in Latine *Mamma*, in Greeke by Hippocrates *μαστος*, by Aristotle *μαστος* of *μαστω*, which signifieth to seeke, because in them Infants seeke their nourishment euen by a naturall instinct: Galen calls them *τις*. No creatures haue paps but such as can beget a perfect creature. And amongst those that haue them, none haue them set afore in the middest of their Chest but onely a man, & indeede this place is most fit for them. For being made for the milke sake which they containe, it behooued they should bee seated in that place where soonest and with most ease, because of the neighbourhoode of the heart which is the shop of heat, the blood might be altered & laboured thereinto; & where also the greatest quantity of the benigne & pleasant superfluity of the nourishment may be gathered.

Moreover, this situation serueth also for more conuenient suckling. For because the infant cannot go, it is necessary that it should bee embraced in the handes and armes of the Nurse; being so embraced it can apply it selfe to no place so fitly as to this; & out of doubt our wise Creator by this position of the breasts did set a marke of distinction between man and

and beast, for beasts do onely nourish their young, and afterwards neglect them: but men doe transfuse out of their heart into their young ones *την καρδιαν*, that is, a naturall affection, which the Latines hauing not beene able shortly to expresse, haue called *Pious loue*, or *piety*. For the Mother doth not onely nourish her Infants, but embraceth them and kisseth them; and so loue being neuer forgotten, at length growes reciprocall and mutuall. But least the heauy breasts should flage downe too lowe because a woman goes alwaies vp-right, they are knit and tyed by their whole *basis* or bottome to the bony part of the chest. They are two, (euen as the whole body almost is diuided into two partes) that like good handmaides they might serue their dame the wombe, which it selfe is as it were parted into two (for the Milke doth not come vnto the breasts til the infant be thoroughly perfected.) And that if there be two Infants, yet they may both at once haue wherewith to satisfy and nourish them, and therefore those creatures which accustomably bring forth more young, haue also more dugges to suckle them with. But if there had beene but one fastened to the middle of the Chest, neyther would the blood haue gotten so well to it, because it should haue had one continued bone vnder it which we call the breast-bone; and beside the infant could not haue bin so handsonly applyed vnto it:

The piety of parents.

Why two.

Why not one.

Their Figure.

Their forme is halfe round, they are hardish and seuered asunder by a middle distance, & in virgins before they be fit to conceiue they are imperfect, so that scarce anything appeares of them but Nipples; but as they grow fitter and fitter for conception, they begin to strut out, become hard and like pleasant Apples, whereupon *Aristophanes* calles them *μῆλα*. They represent as it were a halfe bowle, and when they arise two fingers high, then commonly the monthly courses begin to flow. In women that haue neuer conceived, they remaine knit and as it were gathered vp, but they grow as the belly and the infant in those that be with child. When the Infant is perfect and that the time of deliuerance draweth neere, they swell proportionably as much as the wombe: for there is great consent betweene them by the mediation of vessels, as we shall heare afterward. This consent appeareth, when the infant in the wombe either is not well, (for if it be weake the breasts are full of milke before their time, sayth *Hippocrates*) or is like to abort. Neyerther is it maruell, seeing their offices haue so great affinity, for the wombe was made to receiue the seede, and to perfect the creature, and the breasts to nourish it being brought into the worlde. Also when the infant begins to moue, then beginne they to rise and the nipples to strut: and moreover the infant is lodged on that side where the breast growes greater, whether it be the right or the left.

Their magnitude.

How the Breasts shew the weaknesse of the Infant.

In fat folke they are greater, and in some because of their great weight they hang lowe downe, as it is common among the women of *Ireland*, who neuer vse to tie vp their breasts. In some they grow euen to a monstrous greatnesse as long as they giue sucke, and fall afterward. In olde women they be long and flaccid or loose, so that in extreame age the Kernels and the fat being consumed, onely the skin and the nipples do remaine; sometimes, in such people they are knit wrinklingly vpward.

Irish women haue long and flaccid Breasts.

The parts of the breasts are externall or internall: without, they are cloathed with the Slogh or Cuticle and the true skin, in the middle is the nipple, of which afterward: the internal, are the fleshy Membrane or panicle, the vessels, the kernelly substance and the Fat. The membrane inuesteth their glandulous substance and their fat and knitteth them vnto the Muscles vnderneath by certaine Fibres sent thorough their substance, betweene which Membrane and the skin are the vessels, the Glandules or Kernels and the fat dispersed.

The parts of the Breasts.

Their Vessels are two sorts of veines [Table 27, ab] The first are *cutaneous*, proceeding from the branch of the Axillarie & Humerarie veins which often look very blew, especially in women with child and in nurses, and are distributed into the skinne of the Chest and into the breasts. Their inward veines are about the rootes, which doe not arise from the trunk of the hollow vein at the *Diaphragma*, but when the hollow vein hath first attained to the heart and thence to the collar or patell bones, it lendeth two branches accompanied with two Arteries downward through the whole Chest, and two veines from them are inserted into the Paps, which therefore go so long a iourney that in them the blood might be perfectly boyled; for as it goeth upward it passeth by the heart, and againe descending it is mooued and wrought by the motion of the *Thorax* or Chest which helpeth his more perfect concoction; and these are called the *Mammarie* or Pap-veines and Arteries.

Their vessels. Their outward Veines.

Their inward Veines.

The *Mammarie* descending veine commonly ariseth one on each side from the trunk of the veine called *sub-clauia*, that is, the veine vnder the collar-bones which are called *clauia*.

The mammarie Veines.

The Anastomosis of the mammary veins with the Epigastrick

The consent betweene the wombe and the breasts.

The milk cometh from the wombe to the breasts. How it is that the breasts draw more blood then is needfull for their owne nourishment. Why a milke nurse hath not her courses.

The mammary arteries.

The nerves of the breasts.

The Glandules of the breasts.

The final outlets of the breasts.

nes or clauiculae, and is carried vnder the breast-bone close by the gristles of the ribs, & getting out of the Chest, is vnder the right muscles of the *Abdomen* about the nauell inoculated by *Anastomosis* with the *Epigastricke* veine (which ariseth from the same branch with those which are propagated to the matrix and the necke thereof) which creepeth vppward vnder the right muscles with certaine small tendrils. From the *Mammari* veine betwixt the fourth and the fift ribbes, sometimes higher sometimes lower, there are sent certaine outward boughes through the middle spaces of the Cartilages which ioine the ribs to the breast bone; in men for the nourishing of the interior muscles; but in women (in whome sometimes they perforate the very breast-bone it selfe) both for the nourishment of those muscles, as also to carry the matter of the Milke to the glandules of the breasts in those that giue sucke and to nourish the breastes; for through them a great number of webs of veines are deriued, which nature hath endowed with the faculty of Milke-making. By these vessels sayeth *Baubine* (although others are of other minds) is made the consent betweene the wombe and the breasts (which is so great that onely contraction of them will prouoke lust) which are by them ioined as it were together, so that when the Infant groweth in the wombe, certaine common veines arising from them both doe afford it nourishment; and when the Infant is borne, that attraction of blood ceasing which was strong whilst the Infant remayned in the womb, all the ouerplus of blood floweth towards the breasts, and the breasts like cupping glasses doe draw and pul it blackward and from below. For *Hippocrates* sayth, The Milk cometh from the wombe to the breasts, which after the birth is to be the nourishment of the Infant; and when the woman hath brought forth, the beginning of the motion being once made, that is, if she haue once giuen sucke, the Milk is carried with full streame to the breasts. And this it doth not onely voluntarily, but the Paps draw more blood then their nourishment requireth: which traction or drawing is caused by the Infants sucking, by the amplitude of the vessels, by the motion of the Paps, and for the auoyding of vacuity or emptinesse: for the veines being exhausted by sucking, doe draw blood into themselves on euery side.

Hence it is that a woman cannot well at the same time haue her courses and giue sucke, and *Hippocrates* sayth that milk is German Cousen to the menstruous blood. But to speak as the thing is; the blood is not carried to the Pappes so much by reason of this consent of vessels, as because when the motion of the blood from the whole body to the wombe ceaseth, then the whole body exonerateth or emptieth it selfe into the glandules of the breastes. Wherefore their substance like that of a sponge is very rare or porous, that they might bee able to receiue the greater quantity of liquor.

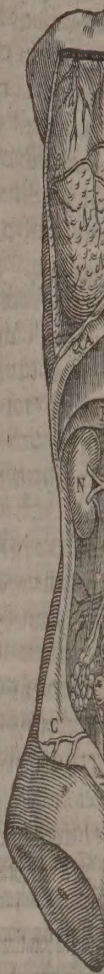
There are also internall *Mammari* Arteries from the vpper trunke of the great Artery, which doe accompany the veines and are ioined with some branches of the ascendent *Epigastricks*. It hath nerves from the sinewes of the Chest which are carried through the skinne partly to the nipples; but the thicker nerue is that which cometh to the nipple from the first nerue of the Chest, and doeth communicate thereto exquisite sence, and is the cause of the pleasure conceiued by their contraction.

The Glandules or Kernels (which they cal in Latin *mamilla* or *mamma*, or rather glandulous bodies) which make the body [Table 27, 28,] or bulke of the Pap, are the greatest of the whole body; white, and do not as in most of the other creatures make one body, but are many and distinct, spongiuous and rare or porous that they might better drawe the Aliment vnto them and conuert it into milke; of these one is the greatest, placed vnder the nipple, and about it are set all the other small ones which cleaue to the muscles of the Throax or Chest.

Among these are infinite vessels with many windings and turnings wouen together, that the blood before in the veines and arteries perfected & receiued by the breasts, might in these boughs and turnings through the glandulous bodies, bee conuerted into milke, which is a surpluse of profitable Aliment.

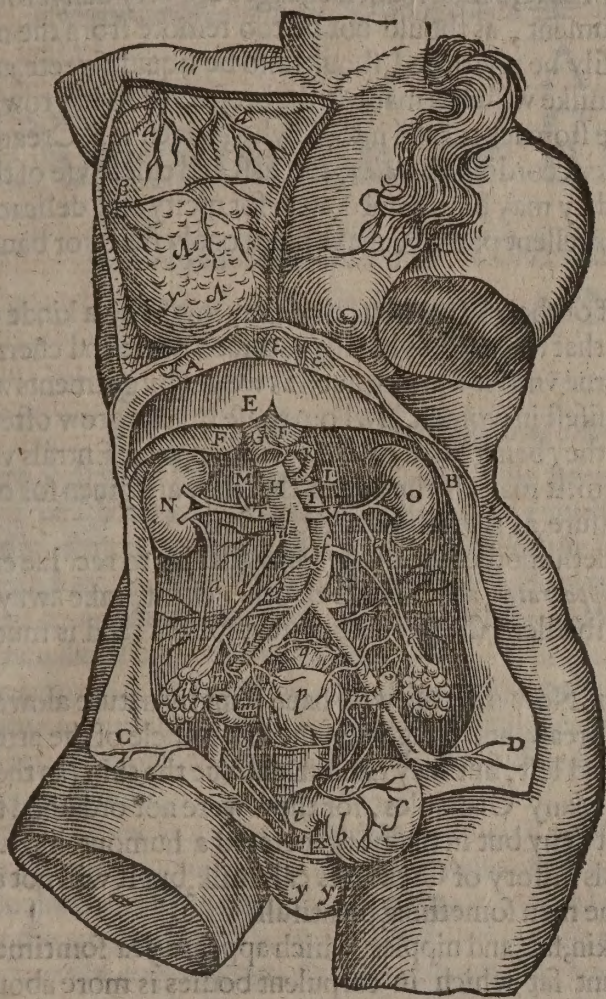
These Glandules in Viginis are hard, in women with Child especially such as haue giuen suck when they are ful of milke they strut more, afterward they grow flaccid & loose, and are as it were consumed. About these is a certaine fat disposed, that it might cherish the heate of the vessels and glandules, and also make the breasts equall. But that the milke that is ingendered in the breasts might better passe out, the breastes are foreward acuminate or sharpned, and that it might not runne at wast but the Infant get it out by sucking, they haue exceeding narrow and straight outlets which are perceiued when the breast head

Table 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.



is pressed that the woman that giueth sucke out of it, then and teates of the breasts, and about them, and teate should euery a more vnequall then a pimple, whele, or yard, whence it is more flaccid or looser and vnequall, very longer and blower. About this teate name it hath, vnequall men with childe and vnequall. From the disease crates saith, a man in his ring which was nipples and the ring gasses drawing heat take them, which is the proper vse of theirs owne childe, is

Table 27. sheweth the breast of a woman, with the skin flayed off. For the rest of the Table belongeth to another place.



- aa The Veines of the Pappes comming from those Veynes which are brought from the top of the shoulder to the skinne.
- β The Veynes of the Pappes comming from those veynes which thorough the arme-hole passe into the hand.
- γ The body of the Pap.
- δ The Glandules or Kernelles of the Pappes, together with the fat amongst them.
- ε The Mammary vesselles descending from the Patell bones vnder the brest-bone.

is pressed that the milke spinneth out, but especially when the Nipples are vlceraed in a woman that giueth sucke. And because the childe cannot take holde of the Pap it selfe to sucke out of it, therefore Nature hath provided the nipples to stand out, as it were the heads and teates of the breastes, which the Infant may enclose with his lips, and lap his tongue about them, and so draw the milke through the outlet or passage. But least this nipple or teate should euer and anon slip out of the childs mouth, it is made rough and rugous, and more vnequall then the rest of the skin.

The Nipples.

Why rugged.

Plato calleth it *σάκος* of *σάκος* to bud forth, in Latine *Papilla*, because it is like *Papula*, that is, a pimple, welke, or wheale. It is of a fungous or Mozy substance, somewhat like that of the yard, whence it is that by touching or sucking it groweth stiffe, and after will againe grow more flaccid or loose. In virgins this teate standeth not much out from the brest, and is red and vnequall, very like a strew-berry; in nurses, because of the childes sucking, it groweth longer and blewer: in old folkes it is long and blackish.

About this teate is a circle, called in Latine *Areola*, in Greeke *ὄρεα*, we know no English name it hath, vnlesse we call it the ring of the pap, but in virgins it is pale or whitish, in women with childe and nurses it is dusky, in olde women blacke, and the skin more rugous and vnequall.

The circle of the Teate.

From the disease of the wombe it is also sometimes yellow, somtimes blacke. For *Hippocrates* saith, a man may iudge of the wombe by the colour of the nipples, for if the nipple or his ring which was wont to be red grow pale, then is the womb affected. The colour of the nipples and the ring about them is also often made dusky and blacke by setting drawing glasses, drawing heades or such like vpon them to make them stand out that the Infant may take them, which may notwithstanding be preuented if care be had.

A good note for women.

The euil cuent of drawing glasses to the Nipples.

The proper vse of the breast, is to be a Magazine or Store-house of meate for the Mothers owne childe, or, that in them so long milke should be generated, as the Infant for his

The vse of the breasts.

nourish-

nourishment should stand in neede of it. For whereas it was accustomed in the womb to be nourished by the Mothers blood conueyed vnto it by the vmbilical veines, it could not so suddenly change that liquid for more solid nourishment, for it could not digest it, because when it is new borne, it is but tender and weake; beside sudden changes are very dangerous, wherefore it had neede of such a nourishment, as should not be too remote from the nature of blood: and that it might more easily be nourished, should also be liquid, sweete, and after a sort familiar vnto it; but such is milke which is made in the breasts. For so in growne men and women, the Aliments are in the stomach turned into Chylus, which is a Creame or substance like vnto Milke. Wherefore according to *Galen*, the first and chiefe vse of the breasts, is the generation of milke, that they may be ashamed, who for nicity and delicacie doe forfeite this principall vse of these excellent parts, & make them onely stales or bauds of lust.

A secondary vse of them, is in respect of their scituation, that they might be a kinde of couering and defence for the heart, and that themselves hauing receiued heate and cherishment from the heart, might again returne vnto it warmth, such as we get by garments we buckle about vs; especially this vse is manifest in women, in whom these breasts grow oftentimes into a great masse or waight, so as they being farre colder then men, their Entrals vnder the *Hypochondria* are warmed by them. It may also be added, that they are giuen for ornament of the Chest, and for a mans pleasure, as is partly touched before.

Note this.

Hippocrates in his booke *de Glandulis* addeth another vse of the Paps, that is, to receiue excrementious moysture: for if, sayeth *Hippocrates*, any disease or other euent, take away a womans Pappes, her voyce becommeth shriller, she proueth a great spitter, and is much troubled with payne in her head.

The Paps of Men.

And thus much of the Pappes of women. Now men likewise haue Paps by nature allowed them, scituated also in the middle of the breast, and lying vpon the first muscle of the arme called *Pectoralis*. They are two, a right and left, but they rise little aboue the skin (as they doe in women) because they haue scarcely any Glandules, for they were not ordained to conuert or containe milke. Yet we do not deny but in them is generated a humour like to milke, which *Aristotle* in the 12. book of his history of Creatures calls milke, but it will not at all nourish, albeit we haue seene it in some men something plentifull.

What humor is in them.

The comparison.

The Paps of Men are compounded of skin, fat, and nipples, which appeare yea sometimes hang forth in them because of the abundant fat which in corpulent bodies is more about that place then in any part of the Chest beside: the nipples of men are somewhat fungous and also perforated.

Their vse.

They haue Veines, Arteries, and Nerues, for their nourishment, life and sence. Their vse is to defend the heart as with a Target or Buckler; or it may bee sayed, that they are giuen for ornament, that the breast should not be without some representation in it. The Nipples are the Center in which the veines and nerues doe determine, which also are therein conioyned.

And here we wil put an end to the History of Parts belonging to Nutrition or Nourishment, and prosecute our intent to discusse the Controuersies and Questions which may arise concerning them.

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A
Dilucidation or Exposition of the
Controuersies concerning the parts
belonging to Nutrition.

QUEST. I.

Whether the Gutes haue any common Attractive faculty.

THe Physitians of old time haue beene at great difference among themselves, whether the Guts haue only an expulsive faculty, or all those foure which serue as Hand-maides to nourishment, the Drawing, Reteining, Assimulating, & Expelling. The occasion of the strife was given by certaynes places of the Greekes and Arabians which were of doubtful construction, for sometimes they acknowledge those foure faculties, sometimes deny them. Our purpose is to skanne and fan this question as neere as we can, beginning our disputation at the Attractive or drawing faculty. But because we would not be puzzled in the equiuocall or want-way betwixt a Faculty and an Action: it shall not bee amisse to sticke downe some stakes, to lay some foundations for our better direction: such are these.

Of Actions some are Common or official, others Priuate or peculiar. The common actions were ordained either for the behoofe of the whole, or at least for more parts then one. So the liuer doeth sanguifie the aliment, not for his owne vse alone, but for the nourishment of the whole body. The heart and the braine doe ingender vitall and animall spirits, to giue life and sence to the whole man; not only for their own particular and priuate vse. The stomach chylieth the meate, not for it selfe (though it take some pleasure in it) but for the liuer. The spleene, the bladder of gal and the kidneies, do not draw the melancholy iuyce, the fiery choler, and the whaey vrine for their owne nourishment, but to depurate and cleanse the Liuer and masse of blood: wherefore these actions are called officiall, because they serue and minister vnto many.

Priuate Actions or peculiar, are such as serue only for the conseruation of priuate and peculiar parts. So the stomach beside his chylickation hath also a particular action whereby it intendeth his owne proper nourishment, drawing, reteining and concocting blood familiar vnto it selfe and expelling the reliques of the same. These things are so notoriously knowne to all men that they neede no curious demonstration.

Another foundation to be layde is this: that for peculiar and priuate Traction & expulsion, there is no neede of the helpe of fibres, but only for the common and officiall; because the priuate is accomplished alwayes without locall motion, but the common with it either alwayes or for the most part. Bones, gristles and ligaments, doe draw and expell without any contraction of fibres; for who euer obserued them to moue in their traction? But as the Load-stone although it moue not, by an inbred and occult propriety draweth yron; and plants which sticke immoueably in the earth, doe suck & draw out of the same earth a iuyce familiar vnto their nature: after the same manner the particular and singular parts of the body out of the masse of blood by a propriety of their own, doe draw and drink into themselves a proper and peculiar nourishment. But the common and officiall traction or expulsion, because they are almost alwayes made with locall motion doe therefore stand in neede of the helpe of fibres. So the motion of the hart although it be naturall, yet is not accomplished without the helpe of fibres, for in his *diastole* or distention, it draweth by right fibres blood through the hollow veine into the right ventricle and ayre by the veynal artery into the left; againe by the transuerse it expelleth spirits, blood and fumed vapors. In like manner the wombe by right fibres draweth the seed of man, and by transuerse is contracted for the exclusion or birth of the Infant.

Two kinds of
actions.
Common or
officiall.

Priuate or
particular.

There is no
need of fibres
to the perfor-
mance of pri-
uate actions.

These

The state of
the question.

Galen.

There is no
common Trac-
tive faculty in
the guts.

3. de nat. facu.

Objection.
Galen expoun-
ded.

The opinion
of late writ-
ters.

Anicen For. 1.
primus.

Their reasons.

Answer to the
arguments.

These foundations being laide, the state of the question standeth thus. When it is demanded whether the guts haue any attractive faculty, we doe not enquire about the priuate & peculiar attraction of the guts, for that is beyond controuersy, considering that life is sustained by nutrition, which is alwaies accompanied by those foure in-bred faculties, attraction, retention, concoction, and expulsion; but the question is concerning a common or official Traction, that is, whether the guts haue power of drawing the Chylus from the stomacke. We thinke they haue not, and *Galen* fauoureth also our opinion; for in his books of the *use of Parts*, he sayeth, *The Guts stand not in neede of an attractive faculty*, and againe, *The Guts haueing no neede either to draw or to reteine because their motion is simple, haue also but simple Fibres*; and in another place euery Gut hath in each coate circular fibres, *For they are contracted only but draw nothing*; the same also he auereth in his 6. booke *de Locis affectis*.

But you will say, if the guts draw not the Chylus, what power or faculty is it which bringeth the same vnto them? Doth the stomack driue out of it selfe so profitable an Aliment? We answer, *Galen*s meaning is, that the Chylus is boyled in the stomack, & that the *Pylorus* or lower mouth all the time of concoction is closely shut vp, that nothing either thicke or thinne may be able to passe away before it be concocted, leuigated and perfectly laboured. When this concoction is throughly celebrated, then is the stomack delighted with the chylus, imbraceth it a while, as being now become familiar vnto it; afterward Nature in a wonderfull prouidence openeth a certaine small membrane, and then the Chylus as it were an ouerplus or superfluity, is driuen forth and falleth into the guts; in whose boughts & circles while it maketh stay, the thinner part like vnto creame is sucked away by the veines of the mesentery; but the thicker by his waight falleth vnto the great guts, and by the circular fibres is thrust forth. Such is *Galen*s true and sound Philosophy concerning this question whereby we are taught that the Chylus is not *drawne* by the guts, but *driuen* into them by the stomacke.

Notwithstanding there want not many among the late writers, who perswade themselves that the guts, especially the smal ones, haue this common tractive faculty inherent in them, and I am perswaded that they build their opinion vpon the authority and som light reasons of the Arabians. *Anicen* writeth that the Chylus falleth from the stomack into the guts, by the helpe and assistance of two faculties; one expulsive of the stomack, & another attractive of the guts; and this also he repeateth in his thirteenth booke *de Animalibus*.

To this authority they adde a threefold reason: First, no man will deny but all the parts do draw a familiar iuyce vnto themselves. Now the Chylus, say they, is the familiar Aliment of the guts, by which they are nourished as the stomack is. Again, if the Chylus be onely driuen out or excluded by the stomacke, then is that motion violent; but it is absurd that nourishment should be made by force or violence, for then it would not endure; the nourishment therefore is drawn not driuen. Lastly, the guts haue right fibres extended in their length and those wee know are onely prepared by Nature where traction is necessarie as being their proper worke.

But those arguments are so sleight & triuiall as a nouice may see their weaknes as he runs. For, first we may not admit of that *paradox* which they obtrude concerning the nourishment of the guts and the stomack; for indeede the stomack is not nourished by the Chylus, but onely delighted with his presence, otherwise, for his nourishment, it draweth bloud by the *Gastricke* and *Coronary* veine, which also it assimilateth as in due place we shall proue. And the guts neither are they nourished by the chylus, but by bloud which is brought vnto them by the meseraick veines; the guttes therefore draw not the Chylus for their nourishment. Whereas they say that the motion of the stomack driuing out the Chylus is violent, I thinke they are farre out of the way; it is rather naturall because it followeth his contraction; against which the natural form of the Aliment, that is, his gravity or waight doth not repugne.

Lastly, we altogether deny that which they affirme concerning right fibres, for in either coate of the guts there is only one kinde of fibres and those circular; & if any right Fibres do appeare, yet is it not in the smal guts which containe the Chylus, but only in the last which is called the *right gut*, in which the excrements are reserued for immediate euacuation.

But let vs grant, that in both the coates of the guts there are right Fibres, yet it followeth not that there is any such drawing faculty as they dreame of, for right Fibres are not alwaies ordained for traction. And this *Galen* doth excellently declare in his fourth booke of the *use of parts*, where he saith, *That the right gut only hath right Fibres allowed it not for traction, but for preservation of the transverse*. For it was to be feared, least the circular Fibres should sepa-

rate

rate or drawne asunder, vnlesse on the outside they had been strengthened by right, as it were by bands or ties; so the Coates of the Veines haue right Fibres not for attraction, but onely *propter duritiem*, as wee say, that is, to hinder an inconuenience. So Chyrurgions for the better reteyning in their due place circular bands, do strengthen them with right Ties or Deligations. And thus much shall be sufficient to haue saide concerning the Attraction of the guts.

QUEST. II.

whether the Guts haue any common Retentive Facultie.



THE authorities of *Galen* aboue alledged do prooue but one facultie of the guts, to wit, the Expulsive; yet there are some which striue out of *Galen* himselfe to prooue common and officiall-Retentive and Concocting Faculties also. Concerning the Retentive we will first see and then of the other. *Galen* discoursing about the nature and causes of the *Lienterie* (a disease wherein the meate is auoyded whole and vndigested as it was eaten, without any notable alteration) referres it to the weakenesse of the retentive vertue; not of the proper Aliment that is of bloud, but of the Chylus containd; the same also doth *Auicenna* determine. Moreover *Galen* 3. de *symptom. causis* sayeth that the concoctiue facultie in Children is stronger, but the retentive and expulsive weaker, because they haue tender bellies, or doe oftentimes vnburden nature; now those things that are auoyded are containd in the guts, the retentive facultie therefore of the guttes is the weaker.

Againe in his booke of *experienced medicines* he prescribeth stipticke or binding medicaments for the fluxe of the belly, to roborate or strengthen the vertue of the guttes; and wee in the *diarrhea* doe apply outward strengthening and astringent things. Adde hereto that most men are somewhat bound rather then soluble, the cause of which action they referre vnto the strength of the retentive vertue, out of *Galen*s commentarie vpon the xx. *Aphorisme* of the second section. Lastly the retention of the Chylus & of the excrement is necessary; of the Chylus, that the Aliments should not suddenly slip away & wee thereby become slaues to our insatiable throates and paunches; of the excrements, least we should be contrayned continually and vnseasonably to auoyde them.

These and such like things they propound, to teach that there is some force and power in the guttes to retaine the Chylus and the excrements, which because they seeme to bee very strange, and abhorring from the determinations of *Galen* and the ancient Physitians, it shall not be amisse to make interpretation of *Galen*s wordes. The *Lienterie* is a disease not of the guttes but of the stomacke, and it is a *symptome* in the ouer hasty egestion or expulsion of meates scarcely at all altered or changed; for *Galen* thus defineth the *Lienterie*, *when the meate is auoyded by the sledge not at all altered or concocted*; and therefore they doe ill that call it a *leuitie* or smoothnesse of the guttes because it may be sometime when they are rough, being an affection of the stomacke onely and not of the guts; for although they be smooth and slippery, yet if the stomacke doe sufficiently boyle the Aliment, we are neuer troubled with the *Lienterie*, because the nature of it consisteth in the priuation of the first concoction, which is celebrated in the stomacke, and in a heady or sodaine egestion; wherefore they conclude amisse that the *Lienterie* proceedeth from the weakenesse of the retentive facultie of the guttes, for that *Galen* conceiteth not; who discussing the causes thereof, referres them to the distemper of the stomacke dissoluing the strength of all his faculties and to a light and superficiall exulceration, whereby that cometh to passe in the stomacke prouoked by the *Lienterie*, which hapneth in the bladder through the strangurie. It is true that the distemper of the guts doth also breed a *Lienterie*, but not at the first had, vnlesse the stomacke also doe sympathize with them, or be drawne into consent by reason of their mutuall society, communion and neighborhood.

And whereas *Galen* writeth that Children are oft troubled with vomitings and loosenesse, hee referres the cause thereof to the weakenesse of their retentive vertue; not of the guttes but of the stomacke, for their fibres are softer; beside their liquid eiections are caused by their continuall eating and greedy appetites, the strength of their naturall heat desiring more then it can containe or concoct; whence it cometh to passe that the fibres, as it were

Concerning the retentive faculty of the guts.

Arguments to prooue it.

Galen, 1.

Auicenna.

Com. ad Aphor.

12 sect 3 ad

Aphor. 12 sect.

4 ad *Aphor.* 1.

sect. 6 ad *Sento.*

13. sect 3 lib.

3. *Eppid.* lib. 1.

de *Crisib.*

22. *Fen.* tract.

3. c. 5.

The former arguments answered.

Galen expounded.

The nature of the *Lienterie*, *Galen*.

Why children vomit and scour of tene.

were the raynes of the stomacke being loosened, they are ouertaken with manifold vomitings and frequent deiections.

The vse of
stipticke medi-
cines in fluxes.

Galen.
The true cau-
ses of costive-
nes.

The reason of
the conuoluti-
ons of the guts

The conclusi-
on.

Those things which they obiekt concerning stipticke medicines which corroborate the guts, and stay the fluxe of the Belly, are but of small moment; for we doe not therefore apply them to strengthen the Retention of the guts which is none at all, but to bind or Contract the veines of the mesenterie, which are dispersed in infinite braunches through the coates of the guttes, and doe empty into them malignant and superfluous humors; or else to thicken, refrigerate, or appease those raging humors which in substance are very thinne, in their Temper very hot, and in their quality very sharpe and coroding; that so they might become more vnapt to moue with such violence and force as they are wont. And what I pray you is more absurde, then to referre the cause of the striction of the belly to the strength of the Reteining vertue? Let them rather harken to *Galen*, who in the third booke of the causes of *Symptomes*, elegantly assigneth the causes of slowe deiection, sometime to the weaknesse of the expulsive power, sometime to the dull sence of the guttes, sometime to the thicknesse, stipticke, or binding nature and small quantitie of that which is eaten; sometime to the weaknesse of the muscles of the *Abdomen*, who haue a great hand & beare a great part in the auoyding of the excrements; but concerning the Retentive power of the guts he addeth not a word, neither maketh mention thereof.

Lastly, whereas they obtrude vnto vs, the necessity of their Retention of the Chylus and the excrements, we admit it very willingly; but doe not ascribe it to the retentive faculty of the guts: for toward the reteyning of the Chylus, the wisdome and prouidence of Nature hath provided the manifold boughts, doublings, and conuolutions or writhen complications of the guttes; so that in so long a iourney and intricate a passage, it is not possible that almost any part of the Aliment should ariue at the port. Esquiline which before was not met withall by the sucking mouthes of the almost infinite veines of the mesenteric. And for the Retention of the excrements, it is not a naturall but an Animall action; because it is performed by the helpe of muscles, to wit, the sphincters, which doe constringe or gather together the lower part of the right gut, that the excrement might not bee auoyded without the commandement of reason and consent of the will. It is therefore hence manifest that the guts haue no Naturall power to reteine the Chylus or the excrement.

QUEST. III.

Whether the Guttes haue any Concocting Facultie.

Three things
required in all
concoctions.



That in euery Concoction there are three things necessarily required; a Preparation, the Concoction or boyling it selfe, and a Perfection after it, *Galen* is a plentifull witnesse. So the preparation of the first Concoction is in the mouth, the Cotion it selfe in the bottome of the stomacke, and the absolution or perfection in the small guts: the preparation to the second Concoction is made in the veines of the mesenteric, the Cotion it selfe in the *Parenchyma* of the Liuer, and the absolution or perfection in the great vessels. In like manner the seede attaineth a kind of rudiment in the *Preparing vessels*, but his *Idea* or forme in the testicles and his perfection in the *Parastata*. The Animall spirite hath a delineation in the wondrous nettes or webbes of Arteries, his forme in the middle ventricle, his absolution in the latter ventricle of the braine; so that in the workes of Nature these manifold degrees of operations doe euery where appeare.

This Concoction of spirites or of Aliment whether it bee priuate or officiall is performed without the helpe of fibres, onely by the assistance and inbred proprietie of our naturall heate, and therefore by *Galen* it is called *Alteration*, and by him not denyed vnto the guts, for so he writeth in his fourth booke of the vse of partes: *The guttes though they were not ordained to Concoct the Chylus, but onely to containe and distribute it, yet because Nature is neuer idle, it attaineth in the passage through them, a more perfect elaboration, even as in the greater vessels there is a certaine facultie of perfecting the blood which was before made in the Liuer.* And this opinion of *Galens* doeth *Arctens* and *Auerroes* follow, which also is seconded by good reason: for the substance of the guts and the stomacke is all one, whether you regarde the Temper or the Color or the frame and texture of their coates. Wherefore

Galen 4. de usu part. lib. 3. de nat. facult. cap. 1. de causis & signis Chronic. morb. cap. 15.

fore the Chylus is concocted in the stomacke, and there attaineth the *species* and forme of Chylus, but as it stayeth in the conuolutions of the guts, and the rugged foldes of their inmost coate, it acquireth also a further alteration.

I am not ignorant, that there is a new Paradoxe maintained by some, to wit, that the guts haue more power to concoct the Chylus then the stomacke, and that in the time of concoction, the *pylorus* is not shut, but that the aliment not yet throughly boyled, falleth thorough the stomack into the guts; and they instance in wounds of the *Hypochondria* and small guts, whence (say they) doth issue a Chylus not yet perfectly concocted, and therefore it hath not his forme or perfection in the stomack.

A paradoxe.

Furthermore, in *Exomphalos* or the rupture of the nauell, the meate passeth forth not perfectly laboured; & in the heighth of Summer when we drinke small drink, we doe instantly feeble the cold in our guts. We answer, that they do not perceiue that in the cases instanced, the guts are ill affected, and the stomack out of hand drawne into consent with them, as well because of their communion and similitude of substance, as also because of their vicinitie: for *Hippocrates* in his Booke of humors hath this golden saying, *These partes which are neere Neighbours, or haue community of substance, are at the first hand and very notably affected.*

Obiection.
Exomphalos,
Answer.

Hippocrates.

It is therefore no wonder that crude or inconcocted and liquid Aliment should flowe from a wounded gut. I confesse that liquid things do sodainely fall downeward, so also is their alteration sodaine and quicke. But they can hardly be perswaded, that the great abundance of meate deuoured by Rauen-stomackes and Trencher-friends can be conteyned in the stomacke alone, seeing *Hippocrates* saith, that the amplitude thereof exceedeth not five handfuls. Yet they must know, that the substance of it is Membranous, and is easily distended into all dimensions: beside, these great gourmandizers do not perfectly concoct the Chylus, because the portall Membrane is loosed before due time by the weight of so great a quantity. We conclude therefore, that the Chylus is concocted in the stomacke and perfected in the smaller guts.

Obiection.

Hippocrates.

Answer.

QUEST. IV.

Of the Expulsive vertue of the guts, and their Peristaltick motion.

That all the guts haue their expulsive faculty very strong, not only for the auoiding of their proper, but also of common excrements; is so manifest, that it needeth no demonstration; as that wherein we are conuincd by the authority of learned men, by the structure and frame of the guts themselves, and by the necessity of this kinde of action. To repeate *Galen*s words out of his sixth Book of the vse of parts in many places, out of his Books *de locis affectis* & *Naturalibus Facultibus*, were to abuse my owne time and your patience. In the structure of the guts if it be well considered, wee shall finde both coates wouen onely with circular and ouerthwart Fibres, ordained for expulsion.

Authorities.
Galen.

And if these things will not moue the froward minds and headstrong wits of men, yet the necessity of the action, which is the snall cause (and cheefe in Nature) must necessarily conuince them. For the excrements being of necessity to be auoyded, the Facultie by which they are auoyded, must needs also bee necessarie; yea more necessarie then the attractive, Nature being ever more diligent to expell that which is noxious or hurtfull, then to attract that which is profitable or behoouefull; and that is the reason why in men that lye a dying, the expiration is stronger then the inspiration, because in expiration the fumed or smoaky vapour which is offensive to the heart, is thrust out; in inspiration ayre is drawne in, which is naturall and familiar vnto it. The expulsive vertue therefore of the guts, is stronger then the rest.

Arguments

The necessity
of the expul-
sive faculty.

Why in the
instat of death
the expiration
is greater then
the inspiratio.

But all this while the manner of this expulsion is not manifested, which in the next place we will endeauour to make plaine vnto you. The excrements are expelled by locall motion; and this motion is double, one Naturall another Animall. The Naturall is proper vnto the guts, the Animall to the Muscles of the *Abdomen*. I call that Naturall which is not voluntary, and that Animall which is done with choyse and discretion. The Naturall motion, which the Ancients called *peristaltic* is accomplished by transuerse and orbicular Fibres contracting the Guts. And this naturall motion is againe double, One According to Nature, another Against Nature. The first is accomplished when the Guts doe contract and gather them-

The motion
of the Gutes
double.
Naturall mo-
tion double.

themselves from above downward, in which motion offensive humors, winde and excrements are driuen down; the other quite contrary when the circular Fibres do gather themselves from below vpward, which is called *ἀνακίνησις*: and in this motion the wind, the Chylus, & the excrements are auoyded by the vpper parts, nothing by the lower although such euacuations be prouoked by sharpe Clisters. *Galen* saith, *This motion hindreth the wind from coming downward, yea it maketh it flye vpward.*

Galen;

Hippocrates.

The causes of the depraued motion.

The manner.

Hippocrates acknowledgeth a threefold cause of this depraued motion, *Inflammation, a confirmed oppilation or stopping, and sometimes a light exulceration.* Inflammations streighten the passages, oppilation altogether shutteth them. So then the excrements hauing no current passage, the expelling faculty following first of all the order instituted by nature, beginneth her contraction in the vpper part, to expell the excrement downward; and this it endeoureth againe and againe, but being frustrated because of the streightnes or stoppage which opposeth her, she inuerteth the order, and begins her contraction from below, and that with such violence, that (alas the while) the Chylus and the excrements are thrown out by the mouth: so diligent and circumspect is Nature to vnburden it selfe of that which is noysome or offensive.

Againe, a light exulceration may cause this depraued motion; as, when the gut is afflicted by the pruritatio or goading of the vlcer it transmiteth vpward such things as would offend it, & as it were altering her saile, beares her course vpward against nature, which before she held downward. This *Peristaltick* motion which is contrary to the naturall, those haue miserable experience of which are afflicted with the lamentable and odious disease called *Ileos* or *Miserere mei Deus*, wherein the seate or fundament is so closed, that a Needle cannot be thrust into it, & if any Clisters be with much ado administred, they are incontinently sucked vp, the circular Fibres contracting themselves from below vpwards. This disease *Hippocrates* in his book *περί τῆς πάθης* calleth a head-strong, sharpe and dangerous affect.

The Ileos.

Hippocrates.

The naturall motions of the guts.

The manner of it.

The vse of the midriffe in the auoyding of excrements.

There is another motion whereby the excrements are auoided, which is *Animal and voluntary*, wrought and accomplished by the help of the Muscles of the *abdomen*; which being contracted do presse and straine the guts and so shut out the excrements, which motion is also furthered by the Midriffe and the Rim of the belly. For the eight Muscles of the *Abdomen*, compressing equally the paunch and the guts, doe alike and indifferently drive the excrements both waies, as well toward the stomach as toward the seate; it was needfull therefore that there should be some assistant part which should drive it downward and turne it from above, which office the Midriffe performs.

QUEST. V.

Whether Clisters can passe upward vnto the Stomacke.



Ecause I haue somtimes heard Physitians disputing about the ascent of Clisters, and haue read *Galen* and *Rhasis* their contrary determinations concerning this matter, I haue thought it fit a little to discusse the question in this place, the rather because the truth may be demonstrated by Anatomickall euidence. *Rhasis* is

Rhasis opinion

Continens is.

Galen opinion

of opinion, that Clisters may ascend vnto the stomach, and are often cast out by the Nostrils, his words are these. *If a Clister bee with great force and violence shot vp, it wil arise at the Stomack: if it be put vp gently and by degrees, it scarce reacheth aboue the great guts.* *Galen* on the contrary iudgeth, that though the Liquor be neuer so forcibly driuen vpward, yet it will scarce reach vnto the empty gut. For in the first book of his Method, he cureth Vlcers of the Lungs, Chest and Stomack by Medicines taken at the mouth; but the vlcer of the guts, both by things taken at the mouth, and also iniected at the fundament with this difference, that if the vlcer be in the great guts he vseth rather Clisters; if in the small, then he sticketh more to medicines at the mouth. The like he repeateth againe in the 13. of his Method, and to him we rather listen in this case then to *Rhasis*; for I haue obserued that the guts are seue times as long as the body of the man whose guts they are; and *Hippocrates* measureth them to be thirteene cubites; and yet that is not all, for the manifold girations or conuolutions whereinto they are circled do breake the force of any iniected liquor.

The great length of the guts.

I thinke therefore that such Liquors do nor reach aboue the blinde gut. For prooffe heereof saith *Laurentius*, I will tell you that which haply few hitherto haue obserued. Let the

the guts be dried and blowne vp a little, & poure some water into the gut called *duodenum*, and it will presently issue out at the right gut; but on the contrary if it be powred into the right gut it wil stay in the appendix of the blind gut because it can get no farther; which proueth that in the end of the blinde gut there is valve which Nature in great wisdom hath set to hinder the refluence or returne of the excrements and vnprofitable humors, such an one as appeareth in the passage of the Choler into the Guts & in the vessels of the heart.

Laurentius his instance that Clifters cannot passe vp to the stomach. The valves of the guts.

But it will be objected that *Galen* in his third booke of the Causes of Symptoms sayeth, That some haue had Clifters so giuen them, as they haue beene cast vp by the mouth, even as the faeces or excrements in that miserable disease called *Ileos* or *volvulus*. We answer that *Galen* here doth not contradict himselfe: for it is one thing to speake of the stomach when it is well affected, and another when it is ill affected. For if the stomacke be well affected the liquor can neuer arise vnto it, but if it be ill affected or affamished, as in the disease called *Boulimos*, it draweth from below not onely such humours as are iniected by the fundament but also the excrements themselves. For as the pined or greedy Liuer draweth from the veines crude & vnconcocted iuyces, so is it with the stomacke, yea with the mouth; for we see what raffe & what odious viands hunger maketh toothsome to such as are pinched therewith.

Objection.

Answer, and Galen expounded.

The force of hunger.

Againe, if the naturall motion of the guttes bee depraued, the circular fibres gathering themselves from below vpward may make a Clifter or other liquor ascend vnto the stomach. If it be objected that nourishing Clifters are carried vnto the liuer, I answer that they arise not thither either of their owne accorde, or by the violence of the liquor iniected, but they are drawne by the veines of the mesentery and thence transported into the Liuer.

Another cause that draweth liquor to the stomach.

How nourishing Clifters come to the Liuer.

QUEST. VI.

Of the Euill Saour of the Excrements.

Any men that are but sleightly seene into the course of Nature, doe wonder much why in a sound body and in a Temperate man the excrements of the Belly become so vnfaourie and abhominably sented, because all stench is the consequence of corruption: and corruption or putrifaction hath for her efficient cause outward and acquired not inbred heate;

Of the saour of excrements.

For whose better satisfaction we say that Physitians acknowledge a double cause of this fœtor or stench, an Efficient and a Materiall. Concerning the efficient they say, that our heate though it be one in regard of the subiect, yet in different considerations it is diuerse, and may be two wayes considered, either simply as it is heate, or else as it is inbred heate and the instrument of all the functions of the soule. As it is heate, it continually feedeth vpon and consumeth the moisture; as it is inbred it boyleth or concocteth, assimilateth and ingendreth; so from the same heate doe flow diuerse yea contrary motions.

A double cause of it. The efficient cause is heat.

Whilest the Chylus is made in the stomacke, the naturall or inbred heate insinuateth it selfe equally and alike into all the parts of the matter; gathereth together those thinges that are correspondent to our nature and separateth the rest: the first are drawne away into the Liuer by the veines of the mesentery, but the other which cannot bee assimilated are thrust downe into the great guttes; and there as vnprofitable are forsaken by the naturall heate; wherefore the heat worketh vpon it no more as it is inbred or direct from the soule, but simply as it is heate taking the nature of an outward heate, and thence comes the stench. Adde hereto the fitnessse of the matter: for these superfluities are crude and verie moyst whence comes putrifaction; but if the humour bee drawne away the putrifaction is lesse, and the saour not so noysome.

And this is the only reason why the excrements of a man most temperate, haue a worse saour then those of other creatures; because a man vseth very moyste nourishment and very diuerse, that is of seuerall kinds, and leadeth a life more sluggish and sedentarie: other Creatures feede vpon dryer Fother and so their excrements become dryer. And this cause *Aristotle* assigned in his *Problemes*: where asking the question why the excrements of the Belly the longer they are retained are lesse vnfaourie, and on the contrary the vrine the longer it is kept smelleth the stronger, he resolueth it thus: Because, sayeth hee, in the long stay, the excrements are dried, and so the nourishment of putrifaction is subtracted or drawne away, which is not so in the vrine.

Why the excrements of men are more stinking then those of other creatures. *Arist. Proble. sect. 13.* *Aprobleme.*

Now

Now the reason of the forme and figuration of the Excrements, is because of the Chambers and cels of the Collicke gut, wherein it swelleth into round and broken peeces.

QUEST. VII.

Of the substance and the scite of the guts.

Galen.
What the substance of the guts is.

Hippocrates.
Aphor. 20.
sect. 4.

Certaine places of *Galen* & *Hippocrates* reconciled.

The error of the Ancients about the scituation of the guts.

Galen.
Com. in 3. Epi.

Divers opinions.

Different conceits about the ascending of the Colon.

Why the pressing of the Spleene makes melancholy bodies to avoid wind downward.

BEfore wee passe from the guts, it will not bee amisse to reconcile some different places of *Galen* concerning their substance. In his Books of Method he saith, that if the guts be wounded or vlcated, they do very hardly ioine together againe, especially the smaller, because their substances is neruous & membranous: but in the 14. book of the vse of parts, he writeth, that the guts & the stomack because they are Instruments of concoction, have a fleshy Composition. And the same *Hippocrates* insinuateth in his *Aphorismes*, where he saith, That if upon a Dysentery or bloody Flux little Caruncles or ragges of flesh doe passe away by seidge, it is a mortall signe. The truth is, that the substance of the guts is neruous or sinnowy, but yet throughout also replenished with fleshy Fibres, so as it may bee saide to bee both Membranous, and also fleshy. Like as *Galen* calleth the wombe sometime a membranous, sometime a fleshy part.

Concerning the scite or position of the guts, the Ancients seeme to haue erred, because they thought that the great guts did occupy the lower part of the belly, and the smaller the vpper: but the truth is, that the Colon which is the greatest of all the rest, runnes vp vnto the hollownesse of the Liuer, and the bottome of the stomacke; but the Ileon is extended downward vnto the share-bones. I conceiue that the Dissection of Dogges and foure-footed Beasts deceiued them. *Galen* himselfe speaking to the capacity of the common people, calleth the great guts the lower, the small guts the vpper, yea and many Physitians at this day are mistaken, distinguishing the Dysentery of the smal guts from that of the crasse or thicke, by this, that if the paine be in the vpper parts then the disease is in the small; if in the lower, then in the great guts.

Concerning the scituation of the Collick gut, there are diuers opinions; some do therefore thinke it ascendeth vnto the bottome of the stomack, that by his contaction as also by that of the neighbor parts, the concoction of the stomacke might be furthered; others imagine, that it is therefore conueyed to the hollow of the Liuer, where the bladder of gall is seated, that the expulsive faculty of the Colon, which lyeth as it were a sleepe, might by the sweating issue of choler be better awaked and set on edge.

Another sort there are who imagine, that the Colon giueth way to the smaller guts, walling them about in manner of a ferce or rampert, comming not neere the center of the Mesentery, and that therefore it taketh vp the left side of the body, that the greater branch of the Port-veine called *Mesentericus*, might with a shorter cut be inserted into the guts and carry or transferre the Chylus vnto the Liuer by a neerer way.

Some there are, who thinke that the Colon adhereth or cleaueth to the bottome of the stomacke and hollow of the Liuer, that by their contaction the remainder of the Aliment which stayeth in the chambers of the Colon, might receiue more perfect concoction. Moreover, they giue this reason of his scituation aloft, that that part of the Chylus which is therein contained might not so soone passe away, and so there might be more perfect and accomplished exsuction of the creame, for which cause also the cels and chambred conuolutions of the Colon, as also the blinde gut were ordained.

This collick gut is indeede the largest or most ample of all the rest, but where it toucheth the Kidnies and the Spleene it becometh narrower, lest it should presse the spleene, whence it comes to passe, that those whose spleens do swel or be notably stuffed, can hardly auoide any winde downward, vnlesse the spleene be pressed.

And thus much concerning the difficulties or curious questions about the guts, wherein wee haue bene somewhat more prolix, that such as delight in the contemplatiue part of Anatomy might not go away from vs altogether vn-satisfied. The stomack followeth.

QUEST.

QVEST. VIII.

Whether the upper mouth of the stomach be the seate of Appetite.

Seeing the liue-tide of euery creature is inconstant, and like a poaste passeth swiftly away, because of the continuall effluxion or expence of the threefold substance wherein it consists, Nature being vigilant & carefull about her owne preservation, endeouoreth continually to make vp the breach by Respiration and Nourishment. By respiration the spirituous, by nourishment the fleshy & solide substance is restored. And hence it is that our nourishment is threefold, *Aer, meate, & drinke*. But because there can be no nourishment without Appetite, Nature hath dispensed to euery part a certaine desire, wherby as by goades they are pricked forward to draw and sucke into themselves conuenient and familiar Aliment. But this desire in the particuar parts of the body is without sense, for they feele not neither perceiue when they draw or sucke such conuenient aliment. Wherefore, lest the parts should pine away when they are exhausted & as it were hunger-starued, nature hath framed one part of exquisite and perfect sense, which alone fore-apprehending the suction and so the want of the rest, should stirre vp the creatures to provide and cooke their nourishment for them. For if the sense of this suction or traction were in euery part, then in the time of affamishment or thirst they would perpetually languish; and so the creature leade his life in a perpetuall disease.

This part so by Nature set out, is the vppermost mouth of the stomach, which the ancient *Grecians* as *Galen* witnesseth, called *καρδια*. And all men doe concur, that in it the Animall appetite or hunger, which is nothing else but a sense of suction, hath his peculiar residence. And this sense is exhibited in this place by two notable nerues called *Stomachici*, or the *Stomacke Nerues* arising from the sixt paire or coniugation of the Braine.

But after what manner this Animall appetite is stirred vp, *Galen* hath elegantly taught vs in his first book of *the causes of Symptoms*. For the better vnderstanding of which place, these things are first to be obserued, that the Animall appetite is double; one naturall, another depraued; to the first, these five signes or symptoms must necessarily cocurre: first, an *exhaustion* or deepe expence of the substance of the parts, next there must be in the same parts a *suction* or traction; for the exhausted parts do draw from their next neighbors & those from others, till by continuation it do come to some extreame; which extreame is the vpper mouth of the stomach where the traction ceaseth: from this traction ariseth the third signe, which is a *diuulsion* or kind of violence offered to the mouth of the stomach, which diuulsion or violence striketh the nerue, whence cometh *sense*, and from the sense the *appetite*.

In the depraued appetite, the same order and degrees of symptoms are not obserued. For in the disease called *Boulimos*, there is hunger without appetite, and in the Dog-appetite, there is appetite without hunger. In the *Boulimos* all the parts being exhausted or hunger-bit, do draw from the stomach, which on euery hand is torne and as it were launced, yet doth not that diuulsion strike the sense, and so no appetite followeth; in the mean time the other parts being defrauded of their alimēt, doe waste away and consume. The cause of this sensibility is the refrigeration of the nerue, the obstruction of the same, and the exolution or fainting away of the appetiue Faculty.

On the contrary, in the Dog-appetite there is no Inanition or emptinesse of the parts, but an exquisite sense of suction, by reason of a coole and sowre humor there impacted, and it is cured *Theorexi*, that is, by drinking of wine as *Hippocrates* witnesseth. Hence therefore it is manifest that the animall appetite is stirred vp in the mouth of the stomach, which is endued with so exquisite sense, that it is called the Organ or Instrument of touching by *Hippocrates* in his Book of *the Instruments of smelling*.

There remaineth yet one scruple, how the Appetiue faculty standing in reference to the sensitive, should haue his seate in the mouth of the stomach, seeing it is of al hands determined that the seate of all the Animall faculties is in the braine. The answer is easy & at hand, to wit, that the faculty it selfe is in the braine, but the work, efficacy & action thereof in the stomach. So the faculty of seeing is in the braine, but the sight is accomplished in the eye. The moouing faculty is likewise in the braine, yet is the Muscle the immediate organ of voluntary motion.

If any man object that the Luer is the seate of the Appetiue faculty, we answer that the

The reason of our threefold nourishment:

The vpper mouth of the stomacke the seate of appetite.

Galen

The Animall appetite double. 5. signes or Symptoms required to appetite.

What *Boulimos* is.

The cause of the dog-appetite.

Hippocrates. *Apho. 2. 1. sect. 2.*

Hippocrates.

Obiection.

Answers.

Obiection.

Answer.

appetite residing in it is concupiscible and without sence, and not sensitiue at all. But wee must not here forget that though this appetite of the stomacke bee with sence, yet it is not ioyned with knowledge or discretion.

Caution.

QUEST. IX.

Of the situation and consent of the uppermost mouth of the stomacke.

THe difference or controuersie concerning the seite of this Orifice is neither light nor vnprofitable, because the resolution thereof stineth the strife among the Physicians concerning the application of Topicall or locall medicines.

The seite of the vpper orifice.

Hippocrates
Lib. de art. med.
lib. sect. 3.

Where to apply locall medicines.

The reason of the paine at the breast bone, when the mouth of the stomack is affected.

The consent of the mouth of the stomacke, with the heart & the braine.

Why vomitings follow the wounds of the braine.
Galen.

All men doe agree that it inclineth rather to the left hand then to the right, but the question is, whether it be neerer the spine of the back, or the gristle and blade of the breast. Some thinke that Nature framed this gristle to be a defence for it and for no other cause, & therefore hath placed it there-under: for say they, those that vomit or reach, doe finde a paine at this gristle and none at the spine or racke of the back. And Hippocrates conceiueth that the extuberation or distention of the stomack at the orifice is not backward but forward; whereas he saith, *That the repletion of the stomack is a direction for broken ribbes.* Wee with Galen doe assigne the place of this orifice to be in the left part toward the spine, not that it lieth or resteth vpon it as the gullet doeth, but because it commeth neerer to the spine then to the breast-blade. And therefore it is that when the gullet or the vpper orifice are affected; we thinke it fit to apply locall medicines both to the back-part and to the fore-part. That that was propounded concerning the paine of them that reach to vomit, and the direction for the ribs, is to be referred to the bottome, and not to the vpper mouth of the stomack; for as we haue obserued, the meate which we eate is not contained in his mouths or orificies but in his cavity, which we doe not deny doeth rather leane to the breast-blade then to the spine.

But the reason why the breast bone is payned when the vpper orifice is affected is meerly Anatomical; the midriffe being tyed to the bone, and the mouth of the stomack adhering to the large passage made in the midriffe for his conueiance thereout; and therefore the breast-blade is payned by this continuity, because paines are rather felt in the extremities or ends then in the middest, as is to be seene in stretched membranes. Concerning the sympathy or consent of this orifice with the heart and membranes of the braine, Hippocrates & Galen are very plentifull; for this mouth being affected, the syncope or sounding, the exolution or fainting of the spirits, and such like symptoms doe ouertake vs as when the heart it selfe suffereth violence, whence this part amongst the ancients as we said before, is called *capula*. In wounds of the head, the skull being either broke or shiuered, & the *dura meninx* or thicker membrane of the braine exposed or laid open to the ayre, which is vncouth or strange vnto it, the Patient presently vomiteth yellow and *Eruginous* or greene choler, because the stomack by reason of society, is drawn into consent and sympathizeth with the membrane, as well because of the similitude and likenesse of the substance, as also of the community of vessels, which are the chiefe causes of consent or sympathy; as Galen obserueth in his *Commentaries* vpon the first section of the 3. book of Hippocrates *Epidemia*. For you must know that *Eruginous* or greene choler is only ingendred and contained in the stomacke.

QUEST. X.

Whether the Chylus be made by the heat, or by the forme of the Stomack: and why the Stomack doth not breede foure substances and excrements as well as the Liver.

Why the stomacke is incompassed with warme parts.



He remouing of these two obstacles and dissolution of the doubts arising in them shall neede no great curiosity; the first wee will determine thus. The Chylus is formed not so much by the power of the heate, as by the ingenite property of the stomacke. True it is that all concoction is accomplished by the help and assistance of heate, and therefore Nature hath provided that the stomacke should be cherished and comforted on every side, aboue and below, on the right hand and on the left, before and behinde; but this concoction belongeth not to the heate as it is heate (for by that reason fiery and aguish heate which corrupteth all things, should be

be the cause of concoction) but as it is the instrument of the soule. For that which wee call chylyfication or making of the Chylus, proceedeth alone from the *forme* and proprietie of the stomacke, because in other parts saving this, the naturall heate though it be very strong and intense yet doth not chylyfie. Now why the stomacke as the Liuer doeth not beget or breede foure kinds of substances, there may bee a double reason assigned; one from the matter, another from the efficient.

A double reason why the stomack breedeth not 4. substances.

The Efficient or working cause is naturall heate, which if it be very strong, it powerfully and effectually or really separateth *Heterogenia*, that is partes that are vnlike or of different natures. But all men know that the Liuer is so much hotter then the stomacke, as bloudy parts are hotter then those without bloud; for the Liuer is a fleshy bowell and the stomack a membranous; wherefore the heate of the Liuer diuideth the Aliment into more particles, which the weake heat of the stomacke cannot doe.

The first from the efficient.

To this efficacy of the Efficient may be added as we sayd the disposition of the matter; for liquid things are more easily altered then solid: now the stomacke receiueth the Aliment when it is solide which with great labour it boyleth, breaketh, and altereth; but the Liuer receiueth it already attenuated and wrought into an equality, when it is no great labor to separate the dissimilar and *Heterogenic* parts, or being separated to driue them into their proper receptacles.

The 2. from the disposition of the matter.

QUEST. XI.

whether the Stomacke be nourished by the Chylus or by Blood.

Inally, that we may passe from the stomack, we will end with that great contro-
uersie which is amongst Physitians concerning his nourishment. Some there are who thinke that the Stomack and the Guttes are nourished by the Chylus, some by crude or raw blood not laboured in the *Parenchyma* or substance of the Liuer; but only hauing an inchoated mitigation in the branches of the port or gate veine.

Divers opinions about the nourishment of the stomacke.

Auicenna thought that the vpper coate was nourished with blood and the inner with Chylus. *Zoara* writeth that the vpper or neruous part is nourished with the Chylus and the lower which is more fleshy, with blood. We with *Galen* determine, that the whole stomack as all other membranes is nourished with pure blood, which hath had his utmost and perfect elaboration in the Liuer. For the prooffe whereof beside the vulgar and ouerworn arguments which Physitians vse, these of no light moment may be cast vnto the heape.

Auicenna.

Zoara.
Galen.

The first is taken from Dissection, because through all the coates of the stomacke and his two orificies, there appeare notable and abundant veines diuersly dispersed, which doubtlesse were not idely or in vaine ordayned by Nature, neither yet to transport the Chylus to the hollownes of the Liuer, howsoeuer *Baubine* be conceited, (vnlesse happely in extremitie of hunger) for then they should carry it rawe, not yet hauing receiued his perfection in the guts.

1. Reason.

Moreover if the veines were especially appointed for the transportation of the Chylus, it being made rather in the bottome then at the sides or top of the stomack, there should haue been more veines and more conspicuous in the bottome then in the top, which experience teacheth vs to be otherwise; for the whole basis and circumference of the vpper mouth is incompassed with an ample vessel called *Coronaria stomachica* or the garland vein of the stomack, because the coats of the orifices are thicker then those of the bottome, and therefore neede more plentifull Aliment. We resoluue therefore that these veines were ordained for the nourishment of the stomacke; but wee will vnder-prop this reason with a stronger.

2. Reason.

In the Chylus although it be laudable and well disposed, yet there remaine some vnprofitable and excrementitious parts; to wit, Choler, Melancholy, and whay or vrine, which cannot be separated or purged therefrom but by the heate of the Liuer. Now nothing can nourish perfectly vnlesse it be cleansed from those recrements: how therefore shall the Chylus not yet defoecated, be sayd to be conuenient Aliment for the stomacke? And this *Galen* seemeth to intimate when he sayth; *That nothing can perfectly nourish which hath not passed through all the concoctions.*

Galen.

A third argument to proue our assertion, that the stomacke is nourished by blood, is because those creatures that mew themselves vp at wintre in holes and rockes and such secret places

3. Reason.

places are nourished by blood, and not by Chylus, because at that time they feed not at all. The infant likewise as long as it is contained in the womb, hath his stomacke without controuersie nourished with pure blood brought vnto it by the vmbilical vein. Hereto *Valerius* in his Controuersies answers, that the Stomacke is nourished by the more crude or rawe part of the Mothers blood which is not much vnlike vnto Chylus. But as well might he say, that the Braine, the Bones and all the Membranes haue their refection therefrom, because they are nourished with Flegmatick and crude blood.

Furthermore, in great weakenesse of the stomacke and loathing of meate, that the patient should not vterly consume, wee prescribe nourishing Clifters of the best sortes of flesh, Capons, Partridges, and such like boyled to a broath. This liquor arieth not at the stomacke, but is sucked away by the Veines of the guts, and transported to the Liuer where it attaineth the forme of blood, and after being carried in the veines as in water-courses vnto the parts, it watereth, nourisheth and refresheth them. Nowe who will say, that at this time the stomacke is nourished by Chylus when there is no chylification therein? and yet I hope they will not deny that it is then also nourished as well as the other parts. Finally this opinion of ours may bee demonstrated by the similitude or correspondencie of the nourishment of other parts like vnto it; and therefore seeing all the membranous parts of the body are nourished by blood, why should the Stomacke among all the rest bee exempted? We do therefore conclude, that the Stomacke is nourished by blood, and that not onely having an initiation or rudiment in the Port veines, but laboured and perfected by the power and efficacy of the *Parenchyma* or substance of the Liuer.

Notwithstanding these things are so, some learned men among the new Writers, as *Thomas Veiga* and *Laurentius Iobertus* doe thinke, and mightily contend by manie arguments, that the Stomacke should be nourished by the thinner part of the Chylus, to which we will make some satisfaction.

In the first place they oppose the authority of *Galen*, who in his third Booke of the naturall faculties, and in the fourth of the Vse of parts in plaine words teacheth, that the stomacke hath his refection and nourishment by the Chylus. For answer to *Galen*, out of *Galen* we say, that there is a double nourishment; the one perfect, which is *Assimilation*, the last vphot and accomplishment of natures endeaours in this kinde; the other imperfect, as it were the *Ape* or imitator of the former, which is a kind of delight the part conceiuet from a quality that is of kinne vnto it; and this kinde of refection *Galen* calleth *Lascina*, as if the entertainment were rather for dalliance then procreation. And in this latter kinde the stomacke according to *Galen* is refreshed by the Chylus, not in the former.

Secondly, they obiekt that no branches of the Hollowe veine are deriued vnto the stomacke and the guts, but onely certaine small rills from the Gate-veine, who haue but one vse, which is, to transport the Chylus vnto the Liuer, and therefore (say they) the organs or instruments of nutrition are not nourished with blood perfected in the Liuer for (there is no commerce by vessels betweene them) but onely with Chylus. This Argument I take to be very ydle and friuolous: for if onely the riuersets or channels of the Hollow-vein did containe Alimentary blood, and the branches of the Gate-veine were only ordayned to transport the Chylus, then should the Spleene, the Mesentery, and the Kell bee likewise nourished with Chylus, because they haue no allowance of Vessels from the hollow vein. In like manner the great guts should assimilate Chylus into their nourishment, in which it is certaine there is nothing conteyned but the excrements, the iuice being before drawn from them.

Their third Argument is taken from Dissection, because (say they) the Veines do onely open at the Stomacke, and are not disseminated through his coates, and therefore they suck iuice from it, rather then nourish it with their owne allowance. But (alas the while) what new Anatomy is this? Is there not a double Gastrick or Stomacke-veyne stretched through all the Coates of the same? Beleue me, the insertion of these and other veines is altogether alike.

The fourth Argument is that of the learned *Veiga*. The Organs (saith hee) of the first concoction are more ignoble, and are framed of farre impurer iuyce then the Flesh; and therefore it is fit they should be nourished also with impurer iuyce, before it is concocted in the Liuer. But this reason drawes many absurdities with it; for the bones are more ignoble then the stomacke or the guts, and colder by farre, and yet are nourished by blood conueyed vnto them from the Liuer by the Hollow-Veine, yea, and almost all the Mem-

branes

Respect diff-
proced.

4. Reason.

How Clifters
do not nourish

5. Reason.

Their reasons
who aouche
the stomacke
to be nourish
with Chylus.

First Answer.

Answer.

Galen expound-
ed.

Second.

Answered.

Third.

Answers.

Fourth.

Answer.

branes colde and base though they be, do draw that blood and no other, which is perfectly concocted in the *Livers parenchyma* or substance.

The Fifth reason followeth, which they put great confidence in, and it is such. If the Stomacke bee not nourished with Chylus, how then commeth it to passe, that presently vpon the taking of Meate both hunger and thirst is appeased? Wee answer, that there is a Double hunger, one Naturall and another Animall: the Naturall is without sense, and placed in the particular parts of the bodye. The Animall is with most exquisite sense, and proper onely vnto the Stomacke, yea especiallie to the mouth thereof: the first is appeased onely by Assimilation; the latter, because it is a sense or apprehension of Divulsion, when the Divulsion ceaseth, then it is also appeased, Vpon the eating of meate, the Animall hunger of the Stomacke presently falleth, because the stomacke being filled, his divulsion and compression ceaseth: but the Naturall hunger is indeede appeased some-what when the inwarde coates are moystened as it were with a pleasant Dewe, yet not altogether before perfect Assimilation, which is not accomplished without some distance or interposition of time. Thus farre their Arguments.

Now because *Galen* saith, that *what soeuer nourisheth must passe through three concoctions: Veiga* to saue his owne Stake, would interpret *Galen* as if hee meant this onlie of the nourishment of fleshie parts, when as in a thousand places he witnesseth that blood alone is the fit and conuenient Aliment of all the parts.

Againe, to establish his false Opinion, hee coyneth verie cunninglie, a three-folde Concoction in the nourishment of the Stomacke. The first (sayth hee) is Chilification, which is made in the bottome: the second, is Sanguification and perfourmed in his Veynes: the third, is Assimilation, which is accomplished in his coates, So that his pleasure forsooth is, that the Chylus is sucked by the Veynes, in them they are turned into Blood, and from them againe are they drawne by the Stomacke for his nourishment.

But in this Triple faigned Concoction, there is a threefolde errour. For first, it is most certaine that the blood by no meanes becommeth redde but by contaction or touching the *Parenchyma* or Flesh of the *Liver*. Againe, I see no reason why the Chylus shoulde bee rather drawne by the Veynes then by the Coates of the Stomacke, if there bee so great similitude of substance betwixt the Chylus and his Membranes.

Finally, if the Chylus were to bee drawne by the Veynes, and there did get some rudiment of blood, it followeth necessarily that the Stomacke is not immediately nourished by Chylus but by blood. And so much concerning the Appetite, Scituation, and Consent of the mouth of the Stomacke, as also of the Chylification and nourishment of the Stomacke it selfe. Now proceede we to the *Liver*.

QUEST. XII.

What is the Nature of a spirit, and whether the *Liner* do breede or get a Naturall spirit.

BEcause in the Schoole of Physitians the Controuersie concerning the naturall spirits is sufficiently bandyed, I wil not spend much time in a thing so notorious; onely for their satisfaction to whom these subtilties are most strange and lesse obuious, I will giue a taste or short assay concerning the nature of spirits.

Galen in his sixt Booke of the *Use of parts*, defineth a spirit to bee *A certaine exhalation of benigne or well disposed blood*: The Stoickes call it, *The tie or band of the soule and the bodie*; for the distance is not so great betweene the highest Heaven and the lowest Earth, as is the difference betwixt the Soule and the Bodye. It was therefore verie necessary that a spirit should bee created, by whose intermediate Nature, (as it were by a strong though not indissoluble bonde) the Diuine soule might bee tyed to the bodie of Earth. Wherefore there are some that say it is an Aetheriall body, the seat & band of heate & faculty, and the prime instrument whereby all the functions of the soule are performed. But to say as the truth is, it is called Aetheriall onely Analogically, because of his tenuity and diuine manner of working, for by his nature and in his originall he is meereley Elementary. Our definition of a spirit shall be this, *A subtile and thinne body alwayes moonable, engendred*

Fift. Answer.

A double hunger.

Galen amisse interpreted by *Veiga*.

Aquaint. conceite of *Veiga*.

Wherein is a threefold errour.

What a spirit is.

How the immortal soule and the mortal body are ioyned.

Galen. What a spirit is.

How the immortal soule and the mortal body are ioyned.

A definition of a Spirit.

of blood and vapour, and the vehicle or carriage of the Faculties of the soule.

Hippocrates.

That they are
corporeall.

Like the wind

An instance.

Galen.

That the spi-
rits are in per-
petuall motio.

A double prin-
ciple of their
motion.

How the spi-
rits are cor-
rupted.

By consump-
tion.

By extinction.

How the spi-
rits are driuen.

How drawne.

The Animall
Spirits how
drawne to a
part.

Whereof Spi-
rits are ingen-
dred.

The vse of
Spirits.

Binding of the
vessels in cer-
cepteth not the
Faculty it selfe.

Spirits double.
Argenterius
his opinion,
that there is
but one sort of
Spirits.

Opinion of
the Ancients,
that there are
three sorts of
Spirits.
That there is
an Animall
Spirit.
Reasons.

That it is a body Hippocrates witnesseth, when he reckons it in the number of those things whereof the body is compounded; for he diuideth the body into *Continentia*, *contenta*, & *impetum facientia*, that is, into parts containing, contained, and such as moue with a kinde of impetuous violence. Another argument that it is corporeall, is, because it stands in neede of a channell or passage wherein it may be transported, because it distendeth the parts in which it is entertained and occupieth a place; for when the creature is dead, both the ball of the eye is corrugated or wrinkled, and the Membranes thereof doe also fall, being no more illustrated by the beames of the spirits. It is therefore a body, but the finest and subtillest substance that is in this Little world. For as the winde it passeth and repasseth at his pleasure, vnscene, but not vnfelt; for the force and incurfion thereof is not without a kinde of violence: so the seede although it be thicke and viscid, yet passeth thorough vessels which haue no manifest cavitie; the reason is because it is full and as it were hoven with spirits. Galen in his third Booke of *Naturall Faculties*, saith, *That blood is thin, vapour thinner, and Spirits thinnest of all.*

I haide moreover, that it was alwayes in motion, for the spirits are continually moued, not by another onely as the humors (which whether they be drawne or driuen are alwayes moued by a power without themselves,) but also of themselves, that is, by an inbred principle of their owne. So that there is a double original of the spirits motion, one homebred, another but a stranger; by the homebred principle they are moued as the flame vpward and downward, as Galen teacheth. Upward, because light; for they are fiery and airy: and downe-ward toward their nourishment. If either of these motions bee hindred, the spirit is corrupted, and that by consumption or extinction; by consumption for want of nourishment when it cannot moue downward; by extinction from his contraries, when it is choaked by cold and moysture because it cannot moue upwards. Again they are moued by an externall principle, when they are Drawn hither or Driuenthither. They are driuen, the Naturall from the Liuer, the Vitall from the heart in his *Systole*, the Animall from the Braine when it is compressed. They are drawne, the naturall by the veines, the vitall by the particular parts together with the Arteriall blood; the Animall verie rarely, vnlesse a part be affected either with paine or pleasure. For in such a case neyther dooth the vehemency of the object suffer the faculty to rest, nor the heate cease to draw the spirits vnto it. The spirits therefore haue a body mouable.

It followeth in the definition, that they are engendred of blood and a thin vapour; so that they haue a double matter, an exhalation of the blood and aire; and therefore it is, that all our spirits are cherished, preserued and nourished by aire and blood.

The last part of the definition designeth the vse of the Spirits, as being the last and finall cause for which they were ordained. For the spirits are the vehicles or carriages, not of the soule, but of the faculties thereof; for if the Vessels, Veines, Arteries, or Nerves be tyed, the life motion and sense of the parts to which these vessels passe, do instantly abate and are in short time vtterly extinguished vpon the interception of the spirits, not of the faculties themselves which are incorporeall, because the band or tye dooth neither interrupt the continuity of the vessell with his originall, neither yet his naturall disposition. And this is the nature of spirits in generall.

Now some spirits are ingenit or in-bred, which are so many in number as there are seuerall kinds and sortes of parts: some influent, which flowe as it were from diuers Fountaines, and serue to rowze and raise vp the sleepey and sluggish operations of the former. Concerning the number of the influent spirits, Physicians are at great difference among themselves. *Argenterius* thinketh that there is but one sort of spirits, because there is but one soule and that hauing but one organ, one blood and one ayre which is breathed in. But the Ancients farre more acutely haue recorded three manner of spirits, because there are three faculties of the soule, the Naturall, the Vitall, and the Animall; three principles, the Braine, the Heart, and the Liuer; and three kinde of Vessels, Veines, Arteries, and Sinnewes.

That there is an Animall spirit, beside that Galen inculcath it in sundry places, many reasons do cunct. For to what purpose else was the braine hollowed or bowed into so many arches? To what purpose are those intricate mazes and labyrinthes of small Arteries which in the Braine we call *rete mirabile*, the wonderfull Net? And why are the sinewes

QUEST. 12.
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of Reason to fee
deth no vehicle
Again, there is
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generation, ther
hereto that ther
the body: for th
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Moreover, se
and impetuous
veines to beate
passe through th
layth the great
vnto the veines
These and suc
they be weighed
For first, Galen
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there is a spirit
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part, but becau
doth consist in
ther influent yet
potentiall vertu
The Arabians
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Thurly, where
a spirit in the Li
great confidence
ced Tyranes. It
uer such as are
others, are to al
source of matter
stored when it i

propagated into so many branches? But of this we shall have occasion to speake more hereafter, as also of the vitall which no man yet euer opposed, and of which the Poet maketh mention, calling it a *Diuinity*:

Est Deus in nobis, agitante calescimus illo.

In vs there is spirit seated,

And by his motion we are heated.

Onely concerning the naturall spirit there hath been some difference, many labouring to blot his name out of the rowle; whose arguments we will here cite before the tribunall of Reason to see how they acquite themselves. First they say that the naturall faculty needeth no vehicle or westage, because it is inbred in euery part, for which they auouch *Galen*. Again, there is no matter whereof this naturall spirit should be made, because there be no vessels whereby ayre may be conueyed vnto the Liuer; neither is there any place for his generation, there being no such cauities in the Liuer as are in the Heart & the braine. Adde hereto that there be no currents or channels to be found whereby it should be led through the body: for the coates of the veines are too thinne to hold or contain an aetheriall Spirit. And truly *Herophilus* well conceiteth that therefore the Artery is manifolde (sixe fold saith he) thicker then the veine, because it was made to containe the Spirits, which by reason of their tenuity, if they had not bene inclosed within stronger wals, would easily haue vanished away.

Moreouer, seeing the spirits as *Hippocrates* sayth, haue in them a kind of nimble violence and impetuous motion, if they were contained within the veines, they would make the veines to beate as do the arteries. Finally, if it be granted that the spirits doe passe and repasse through the veines, yet with what nourishment shall they bee preferred? For heate sayth the great *Dictator Hippocrates* is nourished by moderate cold; now there is no ayre led vnto the veines to serue that turne.

These and such like are the arguments whereby they casse this naturall spirit, which if they be weighed in equal balances will be found too light to sway an established iudgement. For first, *Galen* doth not absolutely deny that there is a Naturall spirit, onely he casteth in a doubt as it were by the by, as also he doeth concerning the vitall spirit, in the fifth chapter of the 12. book of his *Method*, when yet notwithstanding it is beyond all controuersy that it is contained in the arteries. But more plainly in the sixt of the *Use of Parts*, he writeth that there is a spirit contained in the veines; yet are there but few of them, and those darke as he sayeth and cloudy. Wee confesse that there is a naturall faculty bred and seated in euery part, but because the heate and naturall spirit of the parts wherein this inbredde faculty doth consist is but vncertaine like a fugitiue, and dull or stupid; it standeth in neede of another influent yet like vnto it selfe, whereby it might be stirred vp, established, and from a potentiall vertue brought into an operative act.

The Arabians imagine that the blood is transported and guided through the whole body vnder the conduct of the spirit; for although euery part like a Load-stone doe draw vnto it selfe such iuyce as is familiar vnto it, yet if the distance of place be too great, neither can the Load-stone draw yron, nor Amber chaffe, nor the part his nourishment. To their second argument that there wanteth nourishment both for the generation and preservation of this spirit because no ayre is conueyed vnto the Liuer; we answer with *Hippocrates*, that all bodies are *Transpirable* and *Transfluxible*, that is, so open to the ayre as that it may easily passe and repasse through them, though not so abundantly as it doth by the winde-pipe, of which abundance there is no neede, because this thicke and cloudy spirit needeth but a little ayre for his refectiō, which is supplied by transpiration. This transpiration is made in the hollow parts of the Liuer by the Arteries. In the round or gibbous parts although there be no Arteries, yet the midriffe with his continuall motion as it were with a fanne, ventilateth or fanneth, not the Liuer onely, but all the entralles.

Thirdly, whereas they say there is no cauity, no Cisterne, no place for generation of such a spirit in the Liuer; it is truly a very bold conclusion. But let vs stick to them with as great confidence hauing *Galen* on our sides equialent to a whole army of such inexperienced *Tyrones*. It was not necessary saith he that there should be any cauity or cell in the Liuer such as are in the heart, because those bowelles only which were either to receiue from others, are to affoorde and impart together-ward and at once a plentifull and abundant source of matter stood in neede of an ample cauity wherein it would be either treasured & stored when it is receiued, or wrought and framed when it is to be conueyed. The vital spi-

Onid.

That there is
no naturall
spirit.
1. de loc. affect.
12. meth. 6.
in arte parat.
1. Reason.

2. Reason.

3. Reason.

4. Reason.
Herophilus.

5. Reason.
Hippocrates.
6. Reason.

Hippocrates.

Answers to
the former
arguments.
To the first,
Galen.

The naturall
spirit but
cloudy.

The Arabians
conceit.

To the second
Hippocrates.

To the third.

Why the vessels of the Lungs are large.

To the fourth

To the fifth.

To the last.

The Conclusion.

rit as it is very fine and thinne and therefore quickly exhausted; so it behoued that it should as sodainly be regenerated that there might neither want plenty for necessity, nor abundance for sodain expence: it was therefore necessary that it should haue a large cavitie or Cauldron wherein it should be boyled and prepared for vse; as wee see Nature prouided large and ample vessels for the nourishment of the Lungs, because of their continuall motion, which requireth a supply answerable to the expence: but the naturall spirit as it cannot so sodainly spend it selfe, so there was no neede of any abundant affluence thereof, & therefore the beds or webs of the veines were sufficient for his generation.

Fourthly, whereas they say that the thinne coates of the veines are too weake to guide and safe-conduct the naturall spirit; we answere in a word, that a thicke and grosse substance or dull prisoner is easily held in durance.

To the fifth argument we answer, that the veines are therefore not moued, because the faculty of pulsation is not deriued vnto them from the heart; for we doe not thinke that the arteries are moued by the heate and spirits which they containe, but only by a vitall faculty streaming through them by irradiation from the heart, as we shall prooue hereafter.

Finally, they aske how we thinke these spirits should be nourished? We answere, that it is by transpiration which preferueth, refresheth, & maintaineth them, for euery veine hath his artery accompanying him continually, beside the manifold imbracements and inoculations, whereby they are as it were wedded one vnto another. We conclude therefore that there is a naturall spirit, the vehicle or guide of the naturall faculty and of the thicker sort of the blood which is from the Liuer diffused into the whole body.

QUEST. XIII.

Whether the Bladder doe draw the Choler vnto it for his Nourishment.

The seate of the bladder of gall.

Galen.
Falopius.



That there is a small Bladder tied to the hollow part of the Liuer, replenished with a yellow bitter iuyce which wee call *Choler* or *Gall*; there is no man ignorant who hath touched *Anatomy* as they say, but with his vpper lip. But whether this iuyce doe passe vnto the Bladder of it owne accord, or be drawne by the Bladder, or ablegated and sent by the Liuer, it is not altogether so manifest. That a meere *Elementary forme* should leade it by a kind of instinct or Naturall choice (for some choices may be naturall) or election vnto that place, I thinke few men of reason will auouch. More likely it is that it is either drawne or driuen; *Galen* is for both, so is reason also; although *Falopius* that subtle and ocular *Anatomist*, contendeth that it is onely driuen from the Liuer and not drawne by the Bladder, to whome and his arguments we will set our feet in the next exercise.

That the choler is driuen from the liuer.

Why the bladder of gall is fastned to the Liuer.
That it is drawne by the bladder of gall.
Galen.

That the choler is driuen from the Liuer, the very nature of the iuyce doeth sufficiently proue; it is an excrement, in his whole nature and quality hurtfull and noxious, to the Liuer especially; and therefore it ought to be auoided and that sooner and with more expedition, then the other two excrements, because his sharpe prouocations are more offensive, & for that reason the receptacle of choler is tyed or fastned close vpon the cavity of the liuer, but the spleene and the Kidneyes which receiue the other two, are set further off.

Againe that this choler is drawn by the bladder of gall, *Galen* teacheth in his 4. & 5. books of the *vse of Parts*; and beside, the fashion and conformation of the bladder it selfe and his passages doe aboundantly perswade vs therunto; for because there be diuers choler-conduits bending rather down to the guts then to the bladder whose scite is higher; vnlesse the bladder had a peculiar and in-bred traction; vndoubtedly the choler would rather fall downe into the guts then arise vnto the bladder. The bladder therefore draweth this bitter iuyce, and that sincere without admixtion of any more benigne or pleasant humor.

Robert. his opinion.

His reasons.
Galen.

But whether this traction of the Choler by the vesicle or Bladder bee for nourishment, or from a certaine consanguinity betwixt their qualities, or rather by a hidden and vknown propriety, it hath bene a question of old, and yet is not determined vpon record. *Laurentius Iobertus* sets forth a paradox concerning this matter, wherein hee determineth that this Bladder is nourished by Gall, as the Spleene by Melancholy, and the Kidneyes by *Serous* or whaey blood, which opinion may bee established by these reasons. First, it is an axiome in Philosophy and Physicke, which *Galen* often inculcateth and vrgeth in his bookes

bookes of naturall faculties, *That nothing draweth for the drawing it selfe, but for the enioying of that which is drawne*, that is to say, all traction hath some particular end for which it was instituted.

Now the bladder draweth the choler: to what end? No doubt for his nourishment; and this the colour of the bladder perswadeth, which is altogether yellow by reason of the choler assimilated vnto it. Secondly, the Veines that are dispersed and disseminated through the coates of the Vesicle are so small and hairy, that a mans eye can scarce finde them out, and therefore by them the bladder, especially the inner part cannot be nourished. Thirdly, *Galen* witnesseth that the Lungs are nourished by choler, why then may not the Bladder a more ignoble part bee nourished with more impure choler? These and such like are their arguments, who imagine that the traction of the choler is for the nourishment of the bladder.

On the contrary, we being guided by authority, and established by *Galen*s weighty arguments, do not thinke that the Bladder is nourished by Gall but by blood, conducted or led vnto it by the Veines; and that this traction whereof we haue spoken, hath some other end for which it is vnderaken and not for nourishment. *Galen* in his 5. booke of the vse of Parts & the 7. chapter writeth, that both the Bladders because they draw a sincere excrement altogether vnprofitable for nourishment, do stand in neede of bloody vessels or vessels full of blood by which they may be nourished. And againe in the 12. chapter of the 5. booke, he askes the Question why the stomack & the guts haue double coates, and both the bladders but one, and that proper? Hee answereth himselfe thus. Because in the Bladders there was to be no concoction made of those things contained in them; If no concoction of the substance, then no nourishment by the same. To these authorities reason also lendeth her assistance on this manner. All nourishment is by assimilation; but choler cannot be assimilated because it is an excrement; not offensive onely by reason of his quantity, but also in his quality distastfull and vnfauoury. The conclusion we leaue for them to gather who hold the contrary.

A second reason may be, because Nature neuer attempteth any thing in vaine, why then were the two Cysticke twinnes or veines which leade vnto this bladder ordained, if it were not for his nourishment? I confesse they are very small (though our grauer hath cur them large) but yet great enough for the nourishment of so small and vnbloody a part; and so much for the establishing of the truth.

Let vs now another while make answer to the arguments of our aduersaries aboue alleged. The bladder of choler, say they, is yellowish; and that cometh by the assimilation of choler. The conclusion hageth not wel vpon the proposition. For the Colon also in that place where it toucheth the Bladder of Gall groweth yellowish by the transudation or sweating through of the yellow iuice abounding therein; yet who will say for all that, that the Colon is nourished by choler? And whereas they compare the nourishment of the Lungs and the bladder of gal, they forget that choler is one thing and cholerick blood another. The lungs indeede are nourished with cholericke blood, that is very thin and laboured to a height of heate in the left ventricle of the heart, but with excrementious choler no part is nourished.

If they object that the spleene and the kidneies are nourished, the one with excrementitious and foeculent blood, the other with *Serous* & whey; we answer, that we will make any man iudge whether there be the like reason of all these parts, the Kidneies, the Spleene, and this Bladder. For albeit the Spleene doth draw vnto it foeculent blood, and the Kidneyes a *Serous* excrement, yet are not these pure and vnmixed; for their vessels, to wit, the Spleenick branch and the Emulgent veines are very large. Now we may remember that *Galen* saith, that those parts which draw any iuice through ample & large orificies cannot draw it pure and sincere, and therefore the Spleene and the kidneies do draw their excrements mingled with much benigne and alimentary blood, with which blood they are nourished, but the vnfauoury excrement they separate and auoid. But the Bladder draweth vnto it selfe pure and sincere choler, not mixed or adulterated with any other humor, as well because the narrowness of the passage wil not admit any thing thicker, as also for that the attractiō is stirred vp by a familiarity betwixt the bladder and the humour. It remaineth therefore cleared as we hope, that the bladder drawes not the choler for his nourishment.

If it be demanded why then it draweth it? We answer, that *Galen* thought it was by reason of a familiarity and similitude betweene them to vs vnknowne, it may bee also incomprehensible. For as the Load-stone draweth yron, and Amber chaffe; so the bladder draw-

That the bladder is not nourished by the gall.

Galen

That the bladder is not nourished by the gall.

Authorities out of *Galen*.

An argument out of *Galen*.

Reasons.

The first opinion confuted.

To the first argument.

To the third.

Objections.

Answers.

Galen How the Spleene and Kidneyes are nourished.

Similitude

eth

Galen:

Why gall keepeth best in his own bladder.
Objection.

Answer.

Lucretius.

Customers taketh away fence.

Similitudes.

eth choler, with whose presence it is delighted and tickled as it were with a fence of pleasure. For so he sayth in the 10. Chapter of the 5. Book of the *use of Parts*; *Choler is drawn by the bladder, by reason of a communion of qualities.* For as long as the Creature is aliue, though he liue very long, yet alwayes there is choler contained in the bladder of Gall, yea and after death, if wee will keepe the Gall long, wee may preferue it best in his own bladder; neither of them suffering violence by other in any reasonable tract of time, for those things that are familiar and as it were akin, will not offer violence one to another.

If any queasie stomacke shall aske the question how the bladder can be delighted with such an excrement whose rage and acrimony is so fierce that if it stay but a little in the guts it vlceraeth them, and if it be poured into the habit of the body, by irritating the pannicle or fleshy membrane it stirreth vp a rigour or general shivering; how the bladder which is membranous & therefore of exquisite sence, should not feele that acrimony or be offended with so impure a humor? We answer first with *Lucretius*, *That Nature couereth many things under a sacred veyle*, and that in this great vniuerse the sympathies and antipathies of things are secret and wonderfull. Againe, the Bladder is delighted with the presence of the choler, and therefore is not hurt by his acrimonie. Happly also because it is vsed to it, it is not afflicted by it; so those men that are accustomed to poyson, doe not feele the poysonous power thereof, and a drop of liquor strangeth well-nigh the Arterie, whereas full cups delight the stomacke. Againe, the stomacke is pained with a little ayre, and the guts torne thereby with cruell torments, but the Lungs because they are accustomed vnto it, do swallow the aire in great aboundance and are refreshed thereby.

Those men that will not admit of this familiarity or acquaintance betweene the choler and the bladder, doe referre the cause of this Traction to the necessity and prouidence of the vniuersall Nature; to wit, that the blood may be purged, least being defiled with such an excrement, it should become vnprofitable for nourishment.

QUEST. XIII.

Of the passages by which the Choler is purged, against Falopius.

The commendation of Falopius.

Dangerous to vary from the ancients.

The two passages of choler. Falopius his opinion.

Arguments against Falopius.

Abruel Falopius, the most acute and subtle Anatomist of our age, hath deserved exceeding wel in opening vnto vs many things which in the former ages were not knowne. He first of all men did accurately describe the History of a mans Eie, & obserued that gristly body which they call *Troclea*. He first found out the yarde of the wombe called *Clitoris*, beside the manifold nicities foulded as it were in a thousand difficulties, which he hath manifested and brought to light in the Histories of the muscles, the veines, and the sinews; yet notwithstanding this great learned man in his Assignment of the use of the bladder of gal, whilest he describeth the passages whereby the choler is led, in falling frō the authority of the ancients, falleth into an error wherof he cannot be excused.

The ancient opinion and indeede the very truth is, that there are two passages of the gal, one distributed into the Liuer with abundant shootes, the other passeth from the vesicle vnto the guts. By the first the bladder draweth the gall vnto it selfe; by the second it dischargeth it again into the *duodenum*. Falopius on the contrary, conceiteth that those passages of choler which are disseminated through the liuer runne directly not vnto the bladder but to the *duodenum*, and doe continually thrust out the choler thereinto. And because it hapneth full oft, that the guts are either distended with winde, or in the time of distribution are full of Chylus; so that the passage or out-let ordained for the auoyding of choler is intercluded or shut vp; least, saith he, the choler, should flow back and returne vpon the Liuer to defile the blood, Nature hath framed the bladder as it were a diuerticle or cisterne out of the way, wherein the choler might be gathered and reserued together, whilest the out-let in the *duodenum* should be opened.

Wherefore there bee two things which Falopius would haue; the first that the Choler passeth directly from the Liuer to the *duodenum*; the second that the Bladder draweth not choler, but that it returneth thither from the guts when they are distended. Which two assertions, by the fauour of this learned man, we cannot subscribe vnto; because we thinke that we are able to demonstrate the contrary both by reason and sence, the two most certaine Iudges and determiners of al controuersies. First therefore we say and lay as a ground, that

that in the whole frame and structure of the body there is nothing done or generated as accedentary, but onely vpon certaine ground and necessary vse. Now the vse assigned to the bladder by *Falopius* is accedentarie and casuall, for it is not perpetuall that the guts are distended with winde and their passages intercluded; but this happeneth rarely and but to some bodies and those of good constitution. Hence it will follow that the bladder must be vnprofitable, and idly framed by nature, which true and solid Philosophy wil neuer grant. For Nature at no time endeouureth against the causes of diseases, but against such as doe daily and necessarily happen. For it was the originall determination of the great artificer of this noble *Fabrick*, to create a sound and not a sickly habitation for the soule; and therefore he generated the parts at the first hand for themselves, and not afterward or at aduenture, albeit one and the same particle haue many and diuerse by-vses.

Nature ende-
uoureth a
sound body
not a sickly.

The second engine which we conceiue these paper walles cannot withstand, shal be this, that it is necessary that the *Bilious* excrement should passe vnto the Bladder before it went to the out-let in the *duodenum*. For if it should flowe by degrees and perpetuall vnto the guts, it would not moue them to excretion, because a little choler and that falling by drops, would haue beene too weake for this motion. But because it is drawn by the bladder, there- in gathered, and at length abundantly and at once powred forth into the waies of the ex- crements, it moueth them to excretion by certaine distance & with a kinde of suddainesse.

The cause of
euacuations.

Thirdly, vnlesse we admit the Traction of the bladder, and a propriety whereby it is con- tained & retained til a certain time, what would it haue auailed it to be separated from the blood? For if it alwaies descend directly from the Liuer to the gut, then must it be mingled againe with the Chylus and defile it; for the way is open, neither can the distribution of the Chylus as *Falopius* dreameth, interclude the passage of so thin and subtile a humor. Again, if the choler should returne vpon the bladder, onely when the passage into the *duodenum* is stopped, then should not the bladder be alwaies found full of choler, which is euermore to be seene in sound and healthy bodies. Ad hereto, that if the bladder were only provided for a diuerticle to set the choler as it were out of the way; what neede was there of so great a cavity? A little body would haue serued that turne, the first intention of Nature being not to send it thither but vnto the gut. Furthermore if the bladder had no power of Traction, why should the choler rather returne vnto it then vnto the Liuer, when the passage to the vesicle is longer, more crooked and oblique? For if there be nothing but a simple refluxion, it is most reasonable that should be by the broader and the shorter way, which seeing it is not, we conclude that it is drawne.

Finally, if the choler did only regurgitate and flow back and were not drawne, it would not be retained, but dispatched away againe in the same moment as an vnwelcome guest, & so this refluxion should be in vaine. For if it be not familiar vnto the bladder, why should it not prouoke it as it doth the guts and the stomacke?

Nature saith *Galen* vnburdneeth not the gall into the stomack because it was offensive, for if with his bare touch he moueth the guts to excretion, surely it would haue ouerthrowne the concoction of the stomack. *Galen* asketh the question why the guts haue two coates, and the bladders which containe so sharpe humors as the vrine and the choler but one apeece? he answereth himselfe, because the choler is noysome to the guts, but pleasant and famili- ar to the bladder, a little of it prouoketh the guts, and not the bladder, because they draw it not, neither is it familiar vnto them as it is vnto the bladder.

Galen his ob-
jection, cap. 4.
li. 5. de v. sup. par.

His owne an-
swer.

I thinke that the only reason which moued *Falopius* to father this conceite, was because he saw that the passage from the Liuer to the bladder was crooked or oblique, but direct and straight from the Liuer to the gut; and that therefore it could not arriue so soone at the bladder by the crooked passage as at the gut by the straight. Yet againe me thinks this argu- ment or reason should be too light to transport so wise a man; for the motion of the expul- sive faculty is one, and that of the tractive another, and the motion of the Elementary forme different from them both. That motion which followeth the Elementary forme is streight and direct, and rather followeth the shorter, more ample and straighter passages. In the mo- tion of the Tractive faculty which is from the soule, neither doth the obliquity of the pas- sages withstand it, nor the grauity or waight of that which passeth; for phlegmatick blood, although it be heauy ascendeth vnto the braine, and in the time of famine the stomacke re- calleth the thicker part of the Chylus that is passed from it. Seeing therefore the choler is drawn by the bladder, the crooked passage cannot hinder his ready obedience. Beside, the way from the Liuer to the Bladder could not be direct, because it is placed in the hollow-
ness

The motion
which follow-
eth the elemen-
tary forme.

The tractive
faculty.

Objection.

Solution.

Creatures ha-
ving no blad-
der or gall.

Aristotle.

To show that
the bladder is
wanting in some
creatures.Cervi Achaini.
Gall in the
taile.Falopius argu-
ment retortedArguments a-
gainst Falop-
pius.The valves of
the passages of
Choler.

Instance.

The conclu-
sion.Hippocrates.
Galen.The duplicity
of the lower
passage of
choler.Galen.
VesaliusHip de Cibus
ratione in acut.Two sorts of
cholericke
men.A cholericke
Temper.
A cholericke
Habit.A Storie
out of Galen.

ness of the Liuer, so that the passage must first descend, and then ascend. It will be objected, if the bladder do draw the choler because it is familiar vnto it, why doth it then discharge it selfe of it againe? For by the same propriety by which it draweth, it should also retaine & delight it selfe therewith. I answer, that the choler is not excluded vnlesse it be offensive either in quantity or quality; and sure it is, that by long continuance in the bladder, it becommeth more sharpe.

Now whereas it is objected by some, that the bladder draweth not the choler, because many creatures haue it not at all, they heereby conclude nothing. For where the bladder is wanting there he were wood that would say the bladder drew it; but we acknowledge this vse of drawing the choler in those creatures onely at the cauity of whose Liuer a bladder is set. That this bladder is wanting in some creatures, Aristotle writeth 2. de hist. Anim. cap. 15. The bladder of gall (saith he) in some is tyed to the Liuer, in some not: in the Hart and the Hinde it is obserued to be wanting, as also in the Horse, the Mule, the Asse, & the sea-Calf; the Harts called *Achani*, are thought to haue it in their taile; the Elephant & the Dolphin haue no gall in their liuers. In *Euboea Chalcide* an Island in the midland Sea neere Greece, the Cattle haue none; in *Naxos* they haue it double and very large. Finally, if as *Falopius* thinketh, it be so likely that the choler is at first hand led away from the Liuer to the gut because that passage is the shorter, let him giue me leaue to retort vpon him his owne weapon. It shall therefore, say I, retorne from the gut vnto the Liuer rather then to the bladder, because the passage is not so oblique, and so there will become no vse at all of the bladder, if it be onely destinated for a Diuerticle.

But let vs at length passe from reason to experience, which we will exhibite as plainly as we haue often found the same in our Dissections. I say therefore, that from the Liuer to the Bladder, there is an open or through passage and very conspicuous, but not from the Liuer to the gut. Again, from the Bladder to the *duodenum*, there passeth another hollow pipe, but none from the *duodenum* to the Liuer, and in each of these passages there are Valves which hinder the reflux of the choler. That this is so, may easily bee seene if you put a pipe or bugle into the passage of the Liuer, and then blow it, for the bladder will sooner be puffed vp then the gut, because the way is open from the Liuer to the bladder. Again if you put your Bugle into the bladder and blow it, then will the passage of the gut be distended, not that of the Liuer. So then, the choler passeth first from the Liuer to the bladder, and after from the bladder to the *duodenum*.

To conclude therefore, the bladder draweth the choler from the cauity of the Liuer, retaineth the same for a certaine time, and after in a season only knowne and appointed by Nature, dischargeth it againe into the guts. And this was the opinion of the ancient of our Art. *Hippocrates* in his fourth book of diseases, *Galen* in diuers places, and in a word the whole Schoole of Physitions haue receiued it without opposition. Now, where there is so great a consent of learned and wise men ioyned with the authority of all antiquity, I am not easily drawn to dance after the nouell musick of a wanton wit, which shall vary therefrom.

But that there may be nothing wanting in the history of these passages, it is worthy our obseruation, that the way by which the bladder emptieth himselfe, is some times found double, that is, there be two branches thereof, of which one passeth vnto the bottome of the stomacke, and the other to the *duodenum*. *Galen* made mention of both these in his second book of *Temperaments & in arte parua*: and *Vesalius* affirms that he saw it once. Sometimes this channell of choler is but one, & is by nature framed amisse, being inserted in some men into the bottome of the stomack, in others below the *duodenum*, the former sort do continually vomit choler, the later as continually auoide it by seidge; the first are called *πυρροχολοι* *Cholericke upward*, the other *πυρροχολοι κατω* *Cholericke downward*, both *cholericke* (saith *Galen* *ἐξ*, that is) *in their habite and conformation*.

To make these things more plaine, wee must obserue that according to *Hippocrates* and *Galen* there are two sorts of cholericke men, some are so by nature, some by euent or accident. By nature cholericke, is either in Temperament, or in Habite. In Temperament those are cholericke, whose Liuers are hot aboue measure; for a hot Liuer engendreth abundance of choler. In Habite those are called cholericke whose bladder of gall is so formed, that the Canell or passage of the gall runnes either to the stomacke, or the empty gut, and yet both these thus habitually cholericke, may in their temperament be Flegmaticke. There is an elegant history in *Galen*, in his Commentary vpon the second section of the book, intituled *de victus ratione in morbis acutis*, concerning *Paul* the Rhetorician, & *Eudemus* the Philosopher: the

the Rhetorician was the most part cholericke by euent, & leuerie by euent, salt and spiced. But whether they haue made question well practised in the bladder, by one meere imagination, and auoydeth choler in small twiggies, the inserted into the *duodenum* as appeareth in the hard (saith he) to cut times, if we consider the Spleene.

Here be of the Spleen, thirdly, absolutely, but the stomacke, and w of the Schooles maiefty, wisdom our bodies, wh wealth of the fam chronicum, &c. the organ of lang blood prepared & and structure of b vessels; because e dy, either double macke, the wom is in the right si one and the same hope to preuaile so ample bowels again should the tion, when one w of the melanchol vpon the bones an humor in vs, there to place ordaine away by sweats a whose arguments himselfe, partly gant and witty B thereof, that is, the nest part of the thorough the Ar

the Rhetoritian was altogether Flegmaticke, yet vexed with continuall vomitings, and for the most part costive: the Philosopher had many colericke euacuations downeward, but none by vomit. All these are called *Bilious* or cholerick by nature. There are also some cholericke by euent, that is by a temperament acquired, as by labour, watchings, anger, sharpe, salt and spiced meates.

But whether the bladder do draw and driue the choler by one and the same way, many haue made question. A certaine new writer, a great interpreter of *Hippocrates*, but not so well practised in Anatomy writeth, that there are two passages inserted into the body of the bladder, by one of which it draweth, by the other it driueth forth the gall. But these are meere imaginations; for the passage of the bladder is onely one, whereby it both draweth and auoydeth choler, though at seuerall times: yet from this common passage do spring two small twiggies, the one diuersified into the Liuer, by which it draweth onely, the other inserted into the *duodenum*, by which it onely expelleth. And this *Galen* vnderstood right well, as appeareth in the thirteenth chapter of his third booke of Naturall Faculties. *It is not hard* (saith he) *to conceine how traction and expulsion should be made by the same passage at seuerall times, if we consider that the gullet doth not onely leade meate into the stomacke, but also in vomiting casteth it out by the same way.* And thus much of the Bladder of gall, now we proceede to the Spleene.

QUEST. XV.

Concerning the vse of the Spleene against the slanderous calumniation
of Galens Aduersaries.

Here be diuers opinions as well of the Ancient as Moderne writers about the vse of the Spleene, *Erasistratus* thought it not of any great moment. *Aristotle* in his third Booke *de partibus Animalium*, confesseth it to be necessary indeede, yet not absolutely, but by euent, although he sayth it sometime draweth the excrement from the stomacke, and worketh it vnto his nourishment. Both these opinions haue beene hissed out of the Schooles of Physitians, as being neither established by reason, nor agreeing with the maiesty, wisdom, and policy of Nature, who vseth not to create any thing in the frame of our bodies, which is not necessary for the better gouernement and order of the common wealth of the same. *Alexander Aphrodisiens* sect. 2. problem, and *Aretaeus* lib. 1. *de causis & signis chronicorum*, &c. and the author of the booke *de Respiratione* do conclude, that the Spleene is the organ of sanguification, and they call it the bastard Liuer. In this, say they, is the venall blood prepared & concocted; yet doth their beleefe rest vpon coniecture, because the frame and structure of both the bowels is alike; for in both of them there are large and ample vessels; because nature vseth to make the common ministers or seruiceable parts of the body, either double, or if but single then that one is placed in the middest, as the heart, the stomacke, the wombe, the bladder, the mouth, the tongue, and the nose; now seeing the Liuer is in the right side and the Spleene in the left, they seeme to bee two organes ordained for one and the same actiō. But these bareconiectures are too weak to make a party that should hope to preuaile against a common receiued opinion. For how could Nature haue set two so ample bowels which were to serue the whole body in the midst vnder the heart, and how again should she not haue bin idle if she had mad more instruments then one for sanguification, when one was sufficient? *Rondeletius* was of opinion that the spleen is not the receptacle of the melancholy humor, because that humor remaining in his naturall integrity, is spent vpon the bones and other hard and dry parts of the body; and because there is least of that humor in vs, there is no part appointed to receiue the superfluities thereof, like as there is no place ordained to receiue the recrements of the blood, which for the most part do passe away by sweats and insensible transpiration. *Bauhin* runneth a middle course between these whose arguments we haue heard before in the history, and may receiue answere partly by himselfe, partly by the answere to others. *Plinius* a Physitian of *Poytiers* in France, in an elegant and witty Booke which he set out of the Spleene, hath deuised a new and vncouth vse thereof, that is, That in the Spleene the Vitall spirit is prepared: he meaneth that the thinnest part of the blood, which is the matter of the Vitall spirit, passeth from the Spleene thorough the Arteries into the left ventricle of the heart, where it is mingled with the aire,

Bilious by euent.

An idle conceite.

The truth.

Galen.

Erasistratus.
Aristotle.Alexander and
Aretaeus.

Their reasons.

Confuted.

Rondeletius his
opinion.

His Reasons.

Plinius his op
nion.

His Reasons,

and perfected and so powred forth through the arteries, as it were thorough chanelles and water-courses into the body. And this new paradoxe he establisheth with reasons, which carry a shew of great strength and evidence of truth.

The matter (saith he) of the vitall spirit is double, Aire and Blood, and both these stand in neede of preparation and attenuation: the Aire is prepared in the Lungen, but the Blood not in the right side of the hart as *Galen* would haue it, because there are no manifest passages from the right to the left ventricle: not in the Lungen as *Columbus* thought, and therefore in the Spleene.

Hippocrates.

Moreover, we are perswaded (saith he) hereunto both by the structure of the Spleene it selfe, and by the Symptomes or accidents which follow those that are splenetick. For the structure, *Hippocrates* in his first booke *de morbis mulierum*, saith, that the Spleene is rare and spongy, as it were another tongue. Beside, there are innumerable foulds of Arteries therein; now these foulds are no where ordained but for a new elaboration, and therefore in the Braine is the wonderfull or admirable web formed, in the testicles many vessels, in the Liver millions of veines; wherefore it followeth that Nature hath ordained the spleen for the preparing and attenuating of vital blood. Add heereto, that al the Symptomes of splenetick persons, as a liuid or leaden colour, vnseasonable sweate, abouandance of lice, puffings or swellings of the feete, palpitations of the heart, are demonstratiue signes of a languishing or decayed heate and impure spirits.

Florus opinion
Confuted.

The probability of these arguments hath made many to stagger in their resolution concerning this point, and yet notwithstanding if they be called to the touch-stone, wee imagine they will proue no current Coine. For how may it be that the vitall spirit prepared in the webs of the Spleene, should be conueyed by the great Artery vnto the left Ventricle of the heart, when at his orifice there are three valves or membranes shut without & open within, which hinder the ingresse of any thing into the heart? And this *Hippocrates* in his booke *de corde* plainly auoucheth, whose words because they are sweeter then Nectar and brighter then the midday Sun we will willingly transcribe. *At the mouth or ingate of the Arteries, there are three round Membranes disposed, in their top like a halfe circle, and they that prie into these secrets of Nature, do much wonder how these orifices and ends of the great Arteries do close themselves: for if the heart be taken out, and one of these Membranes be lift up & another conched down, neither water nor winde can passe into the heart: and these Membranes are more exactly disposed in the mouths of the left ventricle, and that for very good reason.* Thus farre *Hippocrates*. From whence I gather, if nothing can passe through the Artery into the heart, how shall the blood attenuated in the Arteries of the Spleene passe thereinto, as *Florus* conceiteth? But I know what the answer will be, that those Membranes are not ordained altogether to hinder the passage too and fro; but that nothing should passe together or at once after a tumultuous manner. But this is idle to decline the force of the argument, for the blood that is brought into the heart for the generation of vitall spirits, must both be abundant, and at once abundantly exhibited vnto it; which these semicircular Membranes will not admit. But concerning this question, we shall haue occasion to dispute hereafter when we entreate of the preparation of the vitall spirit, for this time therefore thus much shall suffice.

Obiection answered.
4. vses of the
Arteries of the
Spleene.

Notwithstanding, whereas he objecteth that the large and manifold arteries which are in the Spleen were not ordained in vaine but for a further elaboration of blood, I answer that the vse of the Arteries of the Spleene is fourefold. The first, that by their pulsation they might purge and attenuate the foeculent and drossie blood; the second to solicit or call this blood out of the Veines into the substance of the Spleen; the third to ventilate or breathe the naturall heate of the Spleene defiled and almost extinguished by so impure a commixtion, least it should faint and decay; and finally, to impart vnto the Spleen the vitall faculty. And so wee see how these notable Arteries are not without especiall Reasons ordayned by Nature.

Answer to the
argument of
the Symptomes.
Perfect crea-
tures may liue
without their
Spleenes.

As for the Symptomes which follow Splenetick Patients, they happen from the impurity of the blood, not yet cleansed from this foeculent excrement, and are rather effects of a fault in sanguification then of the store house of the spirits. Moreover, if the Spleen had beene ordained for the preparation of the vital spirit, it should haue been found in all perfect creatures, because that spirit is of absolute necessity for the maintenance of life. Yet *Laurentius* saith, that a few yeeres before he wrote his Anatomy, hee cut vppe at *Paris* in *France* the body of a young man corpulent and full of flesh, wherein he found no spleen at all: the splenetick branch was there and that very large, ending into a small glandulous or kernelly body, and

A story out of
Laurentius.

and the two *hemorrhoidall* veines which purged the feculency of the blood. *Pliny* in the 11. Booke of his *Naturall* history, writeth that the Spleene is a great hinderance to good footmanhippe or swift running, and therefore some doe vse to feare it, yea and they say that a creature may liue though it bee taken out of the side. Againe those creatures which haue lesse of this droffie slime haue no spleenes, and yet it is not to be denied but they ingender vitall spirits. Hereof *Aristotle* is a witnesse, in the 15. chapter of his 2. Booke *de historia Animalium*, where he saith that the spleene is in al creatures which haue blood, but in many of those which lay egges it is so small that it cannot almost be perceiued, as appeareth in Pigeons, Kites, Hawkes, and Owles.

Pliny.

Aristotle.
Creatures that
lay egges haue
small spleenes.

These things being so, let vs now lay downe our opinion concerning the vse of the spleen. We will therefore with *Galen*, that the spleene is ordayned for the expurgation of feculent blood; and therefore Nature hath placed it opposite to the liuer, that the thick and muddy part of the iuyce being drunk vp and exhausted, the blood might be made pure. This melancholy iuyce by a wonderful prouidence and vnknowne familiarity the spleen inuiceth vnto it selfe, yet not pure and vnmingled as the bladder draweth choler, but allayed with much benigne iuyce and laudable blood; because as we sayed before, where the draught is made through large orificies, there the iuyce is neuer sincere, but mixed with some other humor.

Concerning
the vse of the
spleene, agree-
ing with the
truth.

This blood thus drawne and brought by the *Splenicke branch*, the abundance of Arteries doe attenuate, mitigate, & concoct, making it like vnto the Spleen, which is nourished with the purer part thereof. This *Galen* witnesseth where he saith, *That the Spleen draweth thicker blood then the Liuer, but is nourished with thinner, and the impure part sometime belcheth back into the bottome of the Stomacke, sometime falleth into the Hemorrhoidall veines*; and this is the true and vniforme opinion of *Galen* and the most Physitians concerning the vse of the Spleene, which it shall not be amisse to proue also by some arguments. It is most certaine that in the Liuer there are ingendred with the blood three kinde of excrements, one thinne and more ayry which swimmeth aloft and is called *Choler*; another thicker and more earthly answering to the lees of wine, the third watery and whaey. The Choler because his acrimony is more prouoking, is first of all sent aside; the melancholly iuyce as being more myrry and impure, needes the more forcible expurgation; for this expurgation, it was necessary there should be some receptacle and that not far distant from the place of concoction.

Galen.

Confirmed by
reasons.
The first.

This receptacle is neither the stomach nor the guts, nor the kidneies, nor the branches of the hollow veine: it remaineth therefore that it must be the spleene, which receiuerh a notable splenicke branch from the trunk of the gate veine and the lower parts of the Liuer. An argument hereof is the couler of the spleene, which is almost in all creatures blacke or brownish, as also sower to taste: now such as the couler is of any part, such is the humor that hath dominion therein.

From the cou-
lor and taste.

Moreover that the Spleene is ordained for the drawing and purging of the lees of the blood, these things doe sufficiently witnesse: First, because it is most subiect to obstructions and schirrous tumors, not by reason of his substance, for it is rare and fungous like a fast sponge or a smooth pumy-stone, not by reason of his vessels which are very large: wherefore by reason of the humor contained therein, which if it were thin would neither beget obstructions nor such schirrous hardneses. This *Galen* teacheth in the 13. booke of his Method. *The substance*, saith he, *of the Liuer is very liable to the schirrhous, as Naturally containing some myrry and grosse iuyce: the substance of the spleene is more rare and open then that of the Liuer, but yet is oftner afflicted with schirrhous tumors, because of a kind of aliment wherewith it is refreshed.* And againe in his 5. Booke of the *Faculties of simple medicines*. *The spleene hath ample passages.* From whence then proceed these frequent obstructions but from the grosse and feculent blood? In respect of this thicke humor, *Galen* in his 5. Booke *de sanitate tuenda* saith, *That the spleene is helped by the exercise of the upper and lower parts to attenuate it.* And in *Plutarch*, *Orchomenes the Lacedemonian* was very spleeneticke, yet he so exercised himselfe in running, that at length he obtained the prize in a Race.

2. Argument.

Why the spleen
is subiect to
obstructions
and schirrous
tumors.
Galen.

Plutarch.

Furthermore, that the spleene is the receptacle of feculent blood may thus be demonstrated: If the spleene bee obstructed, this muddy blood floweth presently backe vnto the Liuer, and infecteth that which is pure and laudable with his couler, & hence the habite of the body becommeth melancholy, and the patient ouertaken with the blacke Iaundise, euen as when the passage of gall is obstructed the choler returneth into the Liuer, whereupon the whole body becommeth yellow in a yellow Iaundise. For this cause I thinke it was that the Ancients placed the seate of laughter in the spleene, for it is a knowne Disticke.

3. Argument.

The cause of
the blacke and
yellow iaun-
dise.

Cor sapit, ac pulmo loquitur, fel continet iras,

Splen ridere facit, cogit amare iecur.

The seate of wisdom is the Heart, the Lungs our Tongues doe moue;

The Gall our Rage, the Spleene our Mirth, the Liuer holds our Loue.

Plato.

And the Diuine *Plato* alluding hereto, writeth that the Spleene is placed next vnto the Liuer to keepe it alwayes pure and bright and shining like a mirrour, fitte to returne the mages of those things that light vpon it.

Objection.

But there are many things objected against the trueth of this opinion, which is very reasonable we should answer and dissolue. If the Spleen had bene ordained for the drawing and purging of the melancholy iuyce, then Nature would haue provided some passages to leade it from the Liuer; there should haue bene also some cavity to receiue it, and some wayes by which it might be thrust forth. So there are certaine passages of the gal dispersed through the whole body of the Liuer, and hollow like arteries which leade the choler from the Liuer: there is also a notable cavity in the bladder receiuing it, and wayes by which it is thrust downe into the *duodenum*. In like manner, Nature for the vrine provided the emulgent vessels to leade it from the hollow veine; the membranous cavities of the Kidneies to receiue it, and the vreters and bladder to expel and auoyde it; but for the melancholy iuyce there are no proper and peculiar passages to leade it to the Spleene, no cavity or hollownes in the Spleene to receiue and containe it, nor any wayes whereby it might be auoyded; and therefore the Spleene is not ordained for the drawing and expurgation of this humor. That there is no pipe, passage, or vessel appointed for the transportation of these lees of the blood may be proued thus. Nature is so prouident that as soon as sanguification is perfected, she prouideth that the noysome and *heretogeny* parts should be purged and separated from the laudable blood, that it might not be adulterated with theit contagion. But if the melancholy iuyce should passe away by the splenicke branch, this counsell and law of Nature should be vtterly ouerthrowne, because it must needs passe through the trunke of the gate-vein, & defile with his slimy muddines all the branches that belong to the stomack, the kall, and the neighbor parts. Neither can the Spleene be a fit receptacle for this melancholy iuyce, because in it there are no hollow veines, whereas this thicke excrement would occupy a greater place then a thinne. Finally, there are no passages by which these lees might be thrust forth, for it is not returned into the *hemorrhoidal* veins, nor into the bottome of the stomack; because if it were thrust into the *hemorrhoidal* veins, then all men should be troubled with hemorrhoids, because all men haue this foeculent blood: adde hereto, that the blood that floweth by these veines is thinne and purple, not blacke and thicke. Againe, if the Spleene should belch out the reliques of this foeculency into the bottome of the stomacke, it should at length be auoyded either by vomit or by siege, and so we should continually haue sowre vomits or eructations, and blacke stooles.

Answer to the former arguments.

These and such like are the arguments by which the aduersaries of *Galens* opinion doe contend against him. But their blunt weapons will not fasten in the flesh, *Nullus sequitur de vulnere sanguis*. For we answer, that the splenicke branche is a fit vessell for the conueyance of this melancholy iuyce, from which although almost all the veines of the stomacke and the Kall doe arise: yet those parts doe not draw into them this impure blood, but onely the Spleene which by a kinde of familiarity challengeth it as his proper guest. So the Kidneies alone do sucke through their ample vessels the whay, not pure but mingled with the blood.

Galens objection.

His owne answer.

Why there is no notable cavity in the Spleene.

As for a cavity, we doe not thinke it necessary in the spleene, because there are an infinite number of beds and webs of veines and arteries therein, in which the slime and muddy blood is boyled and attenuated: so in the Liuer there are many of these webbes and yet no cavity, as also in the breasts and the testicles. *Galen* in the 4. book of the *use of Parts*, and the 6. Chapter, asketh the question why there bee two kidneies and but one bladder, and one spleene? he answereth himselfe, because the ferous or whacy humor is in greatest quantity, the choler lesse, and the melancholy least of all. The whacy thinnest, the melancholy Lees thickest, and the choler betwixt both. And therefore for a little and thicke humor which was hard to be moued, a great and rare organ was most fit; but it needed not to be hollow, because the melancholy iuyce was not sodainly to be remooued, but by degrees and length of time to be changed and altered. Now, if there be any reliques of this melancholy blood, who will deny that it is auoyded by the Hemorrhoidal veins at the seige, or by the venal vessell into the bottome of the stomacke. Neither doth it hence follow, that the stooles should

should bee alwayes blacke, or the vomits sowre; because a little quantity of this foeculent blood by the heate of the inward parts may bee digested and spent in a vapour, as the excrements of the bones, the gristles, and other parts. But if it abound as it hapneth in melancholy men, then the excrements of the belly, the bladder, and the hemorrhoid veines appeare blacke.

Tis true indeede, that sometimes a right thin, and purple blood passeth away by the hemorrhoides, because the Leeches sucke that which is thin, the thicker setling because of the streightnesse of the wound: or els we say, that there are two kinds of hemorrhoids, the one externall, the other internall; the internall arise from the splenick branch, and the externall from the Iliack: the first do euacuate ill disposed and foeculent blood, the other do empty the turgid and full veines, and therefore the blood that passeth from them is pure and lawdable.

Externall and
internall He-
morrhoids.

QUEST. XVI.

By what wayes the Melancholy iuyce passeth from the Spleene to the bottome of the Stomacke, and for what vse.

Almost all Physicians do agree, that a part of the Melancholy humor is discharged into the Stomacke, but by what passages and to what end, they cannot so well accord. *Auicenna* thought, that it is carried vnto the mouth of the stomacke by the Coronary veine before it enter into the Spleene. *This a strange thing* (saith he) *that the light choler should be sent downeward vnto the guts, to redeeme the stomacke from his acrimony, and the heavy and dull Melancholy should rise upward to the mouth of the Stomacke for the commodity thereof.* *Galen* seemeth to haue thought diuersly concerning this matter. In the 3. Booke of *Naturall Faculties* he writeth, that it passeth from the Spleene vnto the Kall, thence into the guts, and by them to the pylorus, and at length to the bottome of the Stomacke. In his Bookes of *the vse of Parts*, he openeth a neerer way, to wit, the *Vas breue & venosum*, that is, the short or venall vessell, reached from the vppermost branch neere the Spleene to the bottome of the Stomacke.

Auicenna opin-
on.

Galen

In his Booke of *the Dissection of Veines and Arteries*, hee affirmeth that this short vessell is not found in all creatures. For mine owne part (saith *Laurentius*) I haue alwaies obserued it neuer to be wanting. This passage therefore being so short and conspicuous, is most like to be ordained to conuey a part of the Melancholy iuyce, which is like vnto the lees of Wine, into the bottome of the Stomacke which could not bee mittigated and attenuated by the power of the Spleene. Yet I will not deny but that when this short vessell is stopped the grosse iuyce returneth into the splenicke branch, and from it sometimes into the Coronarie veine of the stomack, sometimes into the Hemorrhoidall, and sometimes into the veines of the Mesentery. But why should this Melancholy iuyce be sent back into the bottome of the stomack? the common and true opinion is, that it is done to stirre vp appetite, for it is cold and sowre; now all cold and sowre things because they astringe or binde and corrugate or contract the mouth of the stomacke, doe prouoke appetite. So *Hippocrates* in *Epidemics* saith, *That water is deuouring, and Melancholy men are great eaters.* *Auicenna* thought that this Melancholy did not onely by his astringe stirre vppe appetite, but also further retention & concoction; and of the same minde is also *Galen* in the 5. Book *de vsu partium*, *It streighteneth the Stomack, and contracteth it into it selfe, and maketh it streightly to embrace the meate, and to retaine it till it be concocted.*

What was
ought to
thinke of it.

Why the Me-
lancholy hu-
mor returneth
into the bot-
tome of the
stomacke.

Cold things
prouoke ap-
petite how.
Hippocrates.
Auicenna.
Galen.

Obiection.

Answer

How Quar-
tane agues are
often eased.

The stomacke
ill affected in
quartanes.

If it be obiected, that if it stirre vp the appetite, Nature should haue implanted the venall vessell into the mouth of the stomacke, which we determine to be the seate of appetite; We answer that it is not so placed by the prouidence of Nature, least continually gnawing and prouoking the mouth of the stomacke, it should induce a perpetuall and rauinous appetite. By the benefit and help of this branch, those who are diseased with a quartane Ague (who for the most part haue it very large) are much eased by vomits, whether they come of themselves, or are procured by Art both before and after the Paroxisme or fit, especially in the declination of the Disease. This same branch also is the cause why in Quartanes not onely the Spleene is affected, but also the mouth of the Stomack, yea, almost in all Diseases which proccede from Melancholy the Stomacke beareth a part of the burthen.

QUEST.

QUEST. XVII.

How those that are splenetick are purged by Vrine, and by what waies those purgations passe.

Hippocrates
calleth the
Melancholie
humor water.



And why.

Much sweate
and vrine in
Quartanes.
Melancholy
men great
spitters.

How to purge
it.

Vlcera sceler-
tyrica, how
cured.

Hippocrates
story of Bion.

Anicen.

Experience.

Black waters:
Hippocrates.

How Critical
waters becom
black.

The passages.

That all splenetick and Melancholy persons do abound with Vrine, as well the authority of Hippocrates, as also reason and experience doe perswade. Hippocrates calleth the Melancholy iuyce *Aquā*, that is, Water, in his fourth Booke de Morbis, where he saith, Both the Man and the Woman haue foure kinde of moystures, Flegme, blood, Choler, and Water. And in his Booke de genitura, there are foure kinde of moystures, Blood, Choler, Water, and Flegme. By Water all Interpreters vnderstand the Melancholy humour, because that of all humors hath most Whay or Vrine in it, for it is cold: wherefore when that aboundeth, the naturall heate of the Spleene, the Stomacke, the Liuer, and neighbour parts is wasted and dissolued, from whence proceedeth a great encrease of crudities and waters. Adde hereto that it heloued this crasse humor to haue much whay mingled with it, to be a weftage or vehicle thereunto. Common and daily experience addeth strength to this opinion, for in quartane Agues there is much sweate and much water made, and Melancholy men are all of them *spitatores maximi* great Spitters: therefore Galen out of Dioscorides in his 3. Booke de locis affectis, reckoneth abundance of spittle to be the principall amongst *Hypochondriacall* signes.

This therefore is to be resolued of, that splenetick persons doe abound with serous humour. Furthermore that it is purged by Vrine, Hippocrates, Galen, Anicen, Paulus, and Rhafis doe teach, and we finde it true in our dayly practise. Hippocrates in his Booke de internis affectibus, writeth that the Medicines which are prescribed to splenetick persons, ought to purge by the Bladder; and in his Booke de externis affectibus, hee willeth that those cholerick Patients who haue great and turgid Spleenes, and thereupon are ill coloured or troubled with malignant vlcers, should haue their Vrine prouoked. The moderne Practitioners doe cure the vlcers called *sceleratica*, which are contracted or gotten by the fault of the Spleene, by diureticall and diaphoreticall medicines, that is, by such as prouoke vrine and sweate.

Hippocrates relateth an elegant History of Bion, in the second Booke of his Epidemia, and the Second Section. Bion (saith he) did make much water without any residence, and the blood yssued out of his left nostrill; for his Spleene was puffed up and hard. Galen in his second Booke ad Glanconem, cures Quartane Agues with Diureticall Medicines, such as prouoke Vrine. The guts (saith hee) are to bee purged by the seige, but the Spleene and the Kidneyes by the Vrine.

The same Galen in his Commentaries in sextum Epidem: writeth that Blacke Vrines are signes of a colliquated or resolued Spleen. Anicen Fen. 15. tertij. When splenetick persons (saith he) do vse much exercise, the Melancholy humor is deriued to the passage of the vrine, & the vrines become blacke. And we our selues haue obserued many splenetick persons to haue recovered their health by a liberall and free profusion or euacuation of Blacke Vrines. But wee must obserue that such Vrines are not blacke in their proper liquor, nor in their Generation (because those according to Hippocrates in his Prognosticks, Prorrhethicks and Aphorismes are all mortall, for that they bewray either an extraordinary heate torrifying all things as it were into a blacke Cinder, or else an extinction of naturall heate and a *Morticinium*, that is, an utter deadnesse) but they are blacke through a permixtion of a blacke humor, which the Spleene hath purged and put downe into the Kidneyes.

Now by what passages or wayes this serous and Melancholy iuyce is purged from the Spleen vnto the Kidneyes it is not so easily knowne. There are two kinde of vessels dispersed through the substance of the Spleene: Veines arising from the splenetick branch, and many Arteries.

Betweene the splenetick branch, and the emulgent Veines, there is no communion vnlesse it be as farre off; for the splenetick branch ariseth out of the trunk of the port or gate-veine, but the emulgent from the descending trunk of the *cava* or hollow veine: now betweene the hollow and the gate-veines wee know there is no communion vnlesse it bee by the

the

the mingling of their mouths in the substance of the liuer; for some of the new writers haue obserued many such inoculations betwixt them in that place. Wherefore if the expurgation or auoydance of this melancholy humor be made by the veins, it must be returned from the spleene to the gate, from the gate to the hollow, and from the hollow to the emulgent veines, and so vnto the Kidneyes, which were a long and tedious course.

Our opinion therefore is, that this expurgation is rather made by the Arteries then by the veines, because the humor contained in the spleen, may by a neerer and more open passage be deriued from it vnto the emulgent Artery. So the *Empyici, pleuratici & peripneumonici*, that is, such as haue suppurations in their chest, are afflicted with the pleuresie or inflammation of the lungs, haue the matter or quitture euacuated not through the veins but through the Arteries: and beside, our eyes teach vs that there is more serous and whaey humor contained in the Arteries then in the Veines.

And for this reason I thinke the emulgent Arteries were made so large and so ample, not so much to leade and bring down the vitall spirit (for if they had been but small, they would haue serued that turne) as to purge the whay contained in the arteries by the Kidneyes: for so *Galen* teacheth vs in his 5. Booke *de usu partium*, and in his Booke against *Erasistratus*. And so much concerning the vse of the Spleene, and the way of the melancholy vnto the Stomacke and the Kidneyes. Now followeth that we should treat of the Kidneyes themselves.

QUEST. XVIII.

Of the vse of the Kidneyes, and the matter of the vrine.

Erasistratus and *Asclepiades* as *Galen* witnesseth in his Booke *de Naturalibus facultatibus*, ascribed no vse at all almost to the Kidneyes. *Aristotle* in his Booke *de partibus Animalium*, supposeth that they were at the first intention ordained to hold or containe and establishe the veines, and that in the second place or by the bye, Nature abused them for the excretion of a superfluous humor. We with *Hippocrates*, *Diocles* and *Galen* 1. *de Naturalibus facultatibus*, 5. *de usu partium*, and in his Booke *de locis affectis*, doe thinke that they were framed for the expurgation or cleansing of the Veinall and Artericall Blood. For whereas in the Liuer after concoction, there ariseth a threefold excrement; one *billious* or cholericke, another *feculent* or melancholy, and the third *serous* or whaey; the two former as soone as Concoction is celebrated are purged away, but the third remaineth to conduct the thicke and sluggish blood, that it might more easily and freely passe into the narrow and threddy veines. It was therefore meet that at length hauing performed this his office, it should also be separated and purged as an vnprofitable superfluity, and discharged into his proper receptacles. These receptacles are the Kidneyes, which is euident enough because their substance is hollowed into diuers caues or dennes, and perforated or pierced through with many drayning pipes; as also because of the continuity they haue with the great Bladder of Vrine by the mediation of the Vreters.

But how this expurgation is made, whether by the traction of the Kidneyes, or by the expulsive power of the Veins, or by the proper motion of the whay, or after what other manner, it is not yet fully agreed vpon.

Erasistratus conceived that this expurgation came to passe by a necessary succession of one part of that which was euacuated to another, that is to say for auoyding of vacuity. But we wil not so much as vouchsafe any answer to his opinion. *Hippocrates*, *Diocles*, *Praxagoras* and *Galen*, 1, 2, and 3. *de faculte natural.* 4. *de usu partium*, and 6. *de locis affectis*, doe all conclude that the Kidneyes by a kinde of ingent propriety, doe draw the whay vnto themselves, not pure but mingled with blood. The blood is there referued and applyed to the substance of the Kidneyes like a dew after it is assimilated and turned into their substance; but the whay being vnprofitable for nourishment, is first of all separated, next because of his thinnesse is deriued through certaine fleshy caruncles strutting out like the nipples of breasts, into very many pipes or fistules, and from these into a membranous hollownes, as it were into a Cisterne, and out of it through the Vreters into the Bladder.

Some of the new writers haue thought this expurgation of the whay is not made by the Traction of the Kidneyes, but onely by the expulsion of the Veines: because nothing draweth,

The most likely way:

Why the emulgent arteries were made so large.
Galen.

Erasistratus.
Asclepiades.
Aristotle.

Hippocrates.
Diocles.
Galen.
Of the vse of the kidneyes.

The vse of the whaey humor.

How vrine is made.

Erasistratus.
Hippocrates
opinion.
Diocles.
Praxagoras.
Aristotle.

New writers.
Vrine auoided by the expulsive of the veins.
Their reasons.

weth, *proprie ipsum trahere*, that is, for the drawing it selfe, but that it may enioy that which it draweth; but we know that the kidneies are not nourished with the whay neither with serous blood, because their substance is dense, solid, and compact, and the serous blood very thinne; and therefore the vrine is deriued from the veines, by the power and force of Nature, which is either burnd with abouidance thereof, or prouoked by his saltnes and acrimony. There want not also some which defend the quite contrary, that there is no vse of expulsion in this expurgation, because then there should be a compression of the veines and arteries, the vppermost being contracted and the lowermost relaxed, & by that meanes not only the whay but also the whole masse of blood should be driuen downe into the kidneis.

That there is
no expulsion
at all.
1. Reason.

2. Reason.

3. Reason.

Erasistratus.

Auerrhoes.

Comparison

Reconciliation

The threefold
matter of V-
rine.

Hippocrates.

Why some
thinke the
drinke the on-
ly matter of
vrine.

Answers.

Againe, the scituation of the Kidneyes seemeth to contradict this conceit of expulsion; for if that had beene their end, then their fittest position had beene directly vnder the hol- low veine and the great artery, and not at the sides. Adde hereto, that this expulsion of the whay should not onely haue beene into the emulgent, but also into all the crurall and Iliac branches: yea rather into the lower and neather vessels. And therefore this serous humor, say they, is neither drawne by the kidneies nor by them driuen, but of it owne accord pas- seth vnto them, which passage some haue thought to be by accident, as *Erasistratus* of whose opinion we made mention euen now: others by it selfe, that is, by a proper faculty as *A- uerrhoes* that acute Arabian, who thought that the Aliment was not drawne by the parts, but by an ingenite power and vertue of it owne did passe vnto them. For as in concoction the Aliment getteth a new forme, so it also getteth a new faculty, whereby it is moued to this or that part of the body: so the Elements by their proper formes are moued each to their proper place. But neither *Erasistratus* nor *Auerrhoes* can be approoued, because they both take away the faculties of the soule, especially the Tractiue which ministreth vn- to nutrition.

We as our manner is, to reconcile the different opinions of these great learned men do say, That the vrine is partly drawne and partly expelled; but the force of the Tractiue is greater then that of the Expulsion. And yet we affirme also, that some is onely expelled not drawn at all; and some againe neither drawne by the kidneies nor expelled by Nature, but onely passeth on by a beaten way, which of long time it hath beene vsed vnto. The Vrine when it is naturall and no way tainted, and is onely the whay of the blood, is partly drawne by the Kidneyes, partly driuen by the expulsive power of the veines, especially if all the frame of our naturall and legitimate health doe stand, as they say, in right tune: but yet in this ex- purgation the attractiue vertue of the Kidneyes is very great, and the expulsive of the veins very light and weake.

For why should the whay rather fall into the kidneies then into any other part, vnlesse there were a peculiar Tractiue in the kidneies? In *Perirrhoea* or the Criticall fluxe or the V- rine, it is onely driuen and not drawne by the kidneies: but in a *Colliquation* it is neither dri- uen into the kidneies, because the expulsive faculty is too weake, neither drawne by the Kidneies, but as the Poet saith, of the winde, *Qua data porta ruit.*

Where may it be made,
It followeth glad.

These things that they may be made more manifest and apparent, it shall not be amisse to bring them againe to the hammer and the anuile. The matter of the Vrine is very mani- fold: first all our drinke, sometimes raw and crude and of the same couler it was taken in, sometimes a little altered: secondly, the serous liquor of those humors which are contained in the veins: thirdly all kinde of humors, yea and bodies that are melted, as flesh and fat. This threefold matter *Hippocrates* comprehended in the first section of the 6. Book *Epidemi- on*, where he saith, *The Vrine is of the same couler with the meate and drinke, as well when it is as it should be, as when it is a colliquation or melting of the moysture.* A wonderful, short, plaine, and yet absolute sentence, so as I thinke it vnpossible to expresse more in fewer words.

Whereas he sayeth that the Vrine is of the same couler with the meate and drinke, it sheweth the first matter of the Vrine, to wit, the drinke which some haue thought to bee the sole and onely matter, being perswaded thereto by these reasons. First, because those creatures which doe seldome or neuer drinke haue no bladders, but those that drinke much, do also auoyde much vrine. Secondly, because according to the rule of Physitians, the quan- tity of the vrine should be answerable to the drinke. Thirdly, because in the suppression of vrine, we interdict our Patients drinke, that the quantity of the vrine should not bee en- creased. These things truly proue that the greatest part of the matter of the vrine is sup- plied

plied by the drinke and liquid meates; but they do not conclude necessarily that those are the only and alone matter of it. For the Infant auoydeth water in the mothers womb by the vessell called *Frachos*, yet it drinketh not; and againe in winter wee make more water by much then in summer, & yet we drink lesse. And *Galen* in his first booke *de locis affectis*, telleth a tale of a young man who auoided as much water as came to 4. *Hemina*, that is, 36. ounces, about a quart, and yet in 3. dayes he had taken neither meate nor drinke.

The second particle is (*when it is as it should be*) whereby *Hippocrates* sheweth the second matter of the vrine which is the true and legitimate matter thereof, and that is the whey of the foure humors which are contained in the veines, and therefore *Galen* defineth *per* the vrine, to be *οἷον τῶν κατὰ τὰς φλέβας χυμῶν*, that is, *The whey of the humor in the veines*. As for *Lycus* the *Macedonian*, he is not to be harkened vnto, who affirmed, that the whey was only the excrement of the Kidneyes. For how was it possible that so small bodies as the Kidneyes are, should beget so greata quantity of wheacy humor? And if be obiected, that *Galen* in one place saide, that the vrine is the proper excrement of the Kidneyes and the bladder: Wee will answer, that it is therefore called proper, not because it is engendred in the Kidneyes, but because it is drawne and separated by them alone.

The second matter of the vrine, the whey of the foure humors.

Obiection out of *Galen*.

Answer.

The last particle in *Hippocrates* expresseth the third matter of the vrine, to wit, *All humors and bodies which are melted or colliquated*: the humors are al of them purged by the vrine very often, as in criticall euacuations by the bladder, in a purulent *perirrhæa*, & such as is accompanied with a Strangury, or the Symptomes thereof. There remaineth vpon record concerning this matter a solemne edict of *Hippocrates* in the second section of his first booke *Epidemion*, where he saith, *Many doe auoid vrines bilious, watery, purulent, fretting, and stranguous or issuing by drops*, because as *Galen* interpreteth it, *The whole body did put downe by the vrines great aboundance and varieties of euill humors*. But of this expurgation we shall haue occasion to speake in another place.

The third matter of the vrine are the humors of the body.

Hippocrates. *Galen*.

Neither are the humors only, but also such bodies as are colliquated & melted the matter of the vrine, such as are fat and flesh: and hence come fatty and oyley waters, when a consuming Ague melteth the body, which are called signes of colliquation, whereof *Hippocrates* speaketh in his prognostiquis on this manner, *That vrine is it which is oyley or fat when it is made*: now by Oyleinesse he doth not vnderstand either the colour or consistence of Oyle, but melted or colliquated greace swimming in the surface of the water. Concerning this threefold matter of the vrine, *Ludouicus Duretus* a great learned man of France, hath written at large in his elegant and learned Commentaries in *Coacaspranotiones* of *Hippocrates*.

Hippocrates.

What an oyley Vrine is.

Ludouicus Duretus.

These things therefore being so, and that matter of the Vrine so manifold, we conclude that all vrine is not drawn by the kidneyes, but that only which is naturally disposed, to wit, the whey of the foure humors contained in the veines. Notwithstanding the Kidneyes are not therewithall nourished, for all traction is not for nourishment: the Load-stone draweth iron and Amber chaffe, yet are they not nourished by them. But the vrine (which hath for his matter crude humors or any other) which is freely and abundantly poured forth on the Criticall dayes, we thinke is onely driven and not drawne. But if the vrine do flow from the colliquation or Liquefaction, either of the humors, or of some more substantiall part, it is then neither drawne by the Kidneyes, because it is not *According to Nature*, neyther is it expelled by the power of the veines, because there is a generall exolution or weakenesse of the spirits: but it passeth of his owne accord through most patent and ample vessels to the Kidneyes, because those places are most accustomed to that euacuation. And this I take to be the sum and substance of this Controuerfie.

The Conclusion.

QUEST. XIX.

That the reasons of diuers Symptomes which follow such as are afflicted with the Stone, are to be required from Anatomy.

IT belongeth neyther to this place nor time to dispute about the causes and generation of the stone, we rather sticke to those things that concerne Anatomy. But because *Nephriticall* patients, that is such as are troubled about their Kidneyes, especially with the ston, haue diuers accidents, whereof there can no reason be giuen but onely from Anatomy, I haue not thought it amisse briefly to lay them open with their seuerall causes

causes for the satisfaction of such as are not so well exercised in our Art, who notwithstanding may desire satisfaction in this point.

Paine wander-
ing & fixed.

The *Nephritical* paine doth oftentimes imitate that of the collick, so that by the similitude not only the ignorant but such as are right skilfull are often deceiued. Notwithstanding they are distinguished by their particular Symptomes, by those things which are auoided, and those that are applied. The most greuous Symptom of all the rest is paine, which in the collick is wandering, but fixed in the Stone. The Collick paine ascendeth like as the collicke gut ascendeth, from the bottome of the belly to the stomack, and so runneth vnder the bottome thereof; that of the Stone descendeth, because of the continuity of the vreters, especially if the stone begin to mooue. The Collick paine possesseth all the lower belly, the Nephritick may be covered with ones hand; the collick greueth the region of the *Hypogastrium* and of the nauell, the stone lyeth forer in the Loines backward.

An obseruation
out of the
Arabians.

Some haue obserued out of the *Arabians* that the Collick paine is lesse when the stomack is empty, but the other then is exasperated. And againe, when the stomack is filled the collicke encreaseth, which must be thus vnderstood. That the Collick paine euer abated when the stomacke and guttes are empty, but the Nephritick not alwaies; because the stone lyes goading in the same place. Yet sometimes after meate the Nephritick paine is abated, because the stone being fixed in the kidneyes the waight of it preffeth downward, and thence the paine proceedeth; but when such men haue eaten, the guttes which support and suspend the Kidnies do swell, and so the paine is mittigated. There are also some nephriticall paines which are exasperated vpon the eating of meate, as when the kidneyes are inflamed the distention of the stomack and guts do encrease it. Againe, the paine of the Kidneyes beginnes dully, that of the collick is alwayes a cutting and a sharpe paine. If it be objected, that *Hippocrates* in his Book *de internis affectibus* affirmeth, that the paine of the kidneyes is sharpe;

Obiectiō out
of *Hippocrates*.
Answer
out of *Galen*.

we may answer out of *Galen* that there is a double kinde of paine, the first is occasioned by the Tartnes of the humor, or sharpnesse and asperitie of that which is contained, (imagine it to be grauell) and both these make the paine somewhat acute or stinging; the other is by reason of the waight when the Kidneyes are oppressed with abundance. The paine which proceedeth from Tartnes and acrimony, is both in the generation, and also in the expulsion of that which offendeth: that which is from the weight taketh vp all the time betwixt the generation and the expulsion. Or thus, the paine of the Stone is dull whilst it resteth in the Kidney, and acute when it mooueth into or toward the Vreter. There are also other Nephriticall Symptomes; for the thigh that is on the same side wherein the stone lyes, is as it were benumbed or asleepe, which is not so in the Collicke paine, wherein the vomitings, loathings of meate, and distastfull belchings are more frequent and greuous, and so much of the Symptomes.

Another
meanes to di-
stinguish these
paines.

Secondly, these paines are distinguished by those things that are auoided; for in the collicke the excrements are more obstinately retained, that not so much as a little winde can finde passage, but in the nephritical paine the vrine is rather suppressed. In the collick paine the vrines are thinner in the beginning, and afterward become more thick; and if any winde or flegme be auoyded, the paine is either mitigated, or else ceaseth: but the nephriticall is not appeased till the stone be auoided. Finally, those things that are taken inwardly or applied outwardly, do distinguish these paines.

How the stone
of the Kidnies
is distinguish-
ed from that
of the bladder.

Now the stone of the kidneyes is knowne or discerned from that of the bladder by the propriety of the paine, by the situation, and by the dulnesse. The bladder is placed in the *Hypogastrium*, the kidneyes in the Loynes; the generation of the stone in the bladder is without any sense of paine, because of the largenesse and capacity of the bladder: in the kidneyes it is engendred with paine, because of the narrownesse and streightnesse of the kidney. In the stone of the bladder, the vrine is euermore suppressed, not so in the stone of the kidneyes because there are two of them, that if one be ill affected, the other might serue the turne. Againe, the Strangury and the *Tenesmus*, that is, the pissing by drops and a vaine desire of going to the ground, do alwayes accompany the stone of the bladder because of the vicinity or neighborhood of the right gut, which is not so in the stones of the kidneyes.

The grauell of
the kidneyes red,
and that of the
bladder white.

Some there are which make a difference betweene them in regarde of the grauell, because that of the Kidneyes is redder, that of the bladder whiter: the stone also of the kidneyes is softer, that of the Bladder harder. But this is not alwayes true, for the hardnesse and heate of grauell are to be referred to the power or efficacy of the efficient, and the condition of the matter. And so according to the degree of heate the grauell is eyther white

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or yellow or blacke, and according to the condition of the humour; when they are made of phlegme they are ash-coloured, and red when they are made of blood. But I may seeme here to haue grazed beyond my teather, I therefore returne.

There are two *symptomes* which follow the *Nephretical* paine, a stupor or sleepines in the Thigh on the affected side and a Vomiting. The cause of this stupor, the learned *Langius* in his Epistles, and *Iacotius* in his Commentaries in *Coacas praxiones* of *Hippocrates*, doe referre to the repletion of the veines. The large vessels say they of the hollow veine and the great arterie as they descend downward, doe lye vpon the ridge of the back, and from them there be notable branches scattered vnto the Kidneyes and the thighes, in whose repletion (which happeneth when the Kidneyes, the Vreters, or the emulgent vessels are obstructed) the nerues & the muscles are straightned, and thence that stupor or sleepinesse proceedeth. But this reason seemeth not to me very *Anatomical*; for the stone in the kidneyes doth not cause the veines so to strut that they should presse the muscles, because that many which are wasted with a consumption of the Lungs or some other part whose veins are exhausted, doe notwithstanding in fits of the stone feele this dulnesse or stupidity in their thighes or legges. Adde hereto, that those that are *plethorick*, whose veines are turgid to the outward appearance, haue yet no such stupidity in the legges or armes. Wee must therefore finde out some other cause of this sleepinesse, and I thinke that it is double; the first is the compression of the muscle called *Ischi*, vpon which both the kidneyes do rest, which also all Anatomists doe obserue to bee inserted into the inner part of the thigh, and appointed to bend the same. The other reason is the compression of the nerue which is diuersified into all the muscles of the thigh; & this compression is made by the hardnesse and waight of the stone, for while the stone is small and but a growing, this sleepines hapneth not.

Now the reason why in the fit of the stone there is so great a subuersion or turning of the stomacke, that the Patient loatheth all meates, and presently casteth vp whatsoever hee receiueh, is the sympathy or consent betweene the stomacke and the kidneyes; and the cause of this sympathy which is simple, is not to be referred to their vicinitie or neighbourhood, because there is a good distance betweene them, not vnto the similitude or likeness of their kindes or substances, for the stomacke is membranous and the kidneyes fleshy; not vnto the society or entercouse of their operations, for they are not occupied about one and the same labor; it is therefore to be referred to the communion and continuation of their vessels and membranes. For there are certaine small nerues which are carried from the stomacke nerue to the kidney; and the outward coate inuesting the kidneyes which is commonly called *fascia* or the *swathe*, hath his original from the *Peritoneum* or rim of the belly, which all men know is continued with the bottome of the stomacke.

The cause of the stupor of the thigh in the paine of the stone, out of *Langius* & *Iacotius*.

Confuted:

A double cause of the stupidity as is signified.

Why the stomacke is subuerted in the fits of the stone.

QUEST. XX.

Whether the Bladder doe drawe the vrine.

Concerning the Tractiue, Retentiue, and Expulsiue faculties of the Bladder, in respect or reference to the vrine, there are some small difficulties which had neede to be made plaine. And first there may bee question made of a tractiue faculty, for *Galen* sometimes alloweth, sometime denyeth it. In the 3. Booke de *natural. facult.* and the 5. de *usu part.* he writeth that both the bladders of the gal & of the vrine haue a proper power to draw their own excrement. And this the structure or frame of the bladder doth also conuince, for it appeareth to be wouen of three sorts of fibres, right, oblique & transuerse. And in the 7. chap. of the 5. booke de *usu part.* The bladder saith *Galen*, as well that which receiueth the vrine as that which receiueth the *Choler*, because both of them doe draw their proper excrements pure and segregated from the rest, do both of them by due right make claime vnto other vessels which should conuay nourishment vnto them. *Aristotle* in the 15. Chapter of the third Booke de *histor. Animal.* sayeth, That after death no humor falleth into the bladder, but whilst men are aliue not onely humour, but also dry recrements doe passe downe, of which stones are ingendred. Now if the whay did only descend & were not drawne, why should it not descend also in dead bodies? *Galen* in the 6. Booke de *locis affectis*, seemeth to be of a contrary opinion. For searching into the nature of the disease called *Diabetes*, that is, an exceeding fluxe of vrine, and the causes thereof, he affirmeth, that the bladder doth not draw the vrine vnto it selfe. But I vnderstand *Galen* that where he sayth in the *Diabetes*, The bladder draweth no whay vnto it selfe, his meaning is, that the cause of the *Diabetes* is not to be referred to the Tractiue power of the

Whether the bladder haue any attraiue faculty. *Galen*.

Galen.

Aristotle.

Galen.

The cause of Diabetes. *Galen* expounded.

the bladder, neither that it is at any affection of the bladder, but rather a symptome of the exceeding strength of the Tradition of the Kidneyes, and of the weaknes of their retention, & therefore in that disease the bladder draweth not so great a quantity of vrine, but the hot and boyling Kidneyes draw more whay then they are able to conteyne, whence either of it owne accord it falleth through the vreters into the bladder, or is thrust downe by violence.

How the bladder is nourished.

But if all things stand in good order according to the laws of Nature, then there is no reason but to think that the vrine is drawn by the vreters and the Bladder. Neither doe I think that the bladder is nourished by that excrement, considering that from the *Hypogastricke* branch there are many smal rillets of veins and arteries disperfed through both his Coates.

QUEST. XXI.

Of the Retention and Excretion of the Vrine, whether it be accomplished by a Naturall or by an Animal faculty.

Retention and excretion are natural actions.

THE proper vse of the Bladder is to retayne the Vrine to a certaine time, & afterward to auoyde it; but by what power it doth this, Animal or Naturall, there lyes the controuersie. Some conceite that both the actions, as well the Retention as Expulsion are Naturall, because there is the same reason of both the bladders of gall and of vrine, but the bladder of gall reteineth and expelleth onely by the faculty which we call Naturall. Adde hereto that the triple kinde of fibres which are in both the bladders doe perswade vs that there is a threefold Naturall action in them and not an Animal. On the contrary, it may bee demonstrated that both these actions are Animall on this manner. The Retention is made by Animall instruments, and therefore the action is Animall, this Animall instrument is a muscle. Now we know that the necke of the bladder is compassed about with a *sphincter* muscle, who playes the Porter and stoppeth the gate least the Vrine should passe away without our good pleasure.

That they are animal.

Galen.

What our resolution is.

That the Expulsion is Animal is witnessed as by other arguments, so by this, that according to our arbitrary wil it is either slower or quicker, weaker or stronger, as also because it is not acomplished without the help of the muscles of the *abdomen*. *Galen* in his first Book *de locis affectis*, and 6. Chapter, stinteth this strife, and sayth that the action is mixt: the Retention, Animal, and voluntarie, as being performed by the helpe of a muscle, the Excretion Natural which is vnderaken & performed by the expulsive faculty: For my owne part I thinke that both actions as well the Retention as the Expulsion, are partly naturall & partly Animall, but the Retention more Animall, and the Expulsion more Naturall. The Vrine is retained in the bottom of the Bladder by the help of the oblique fibres; now that Retention is natural: but beside it is retayned also at our pleasure by the helpe of the *sphincter* muscle, and this action is meerely Animall. The vrine is Expelled by the ingenite power of the Bladder, whereby it is prouoked to auoyde that which is noysome or grieuous vnto it, and this Excretion is altogether Naturall. Again, the Vrine is Expelled at our pleasures (and that action is Animal) by the helpe of the muscles of the *Abdomen* pressing the *Hypogastrium* or water course; and some thinke that those small muscles of the *Abdomen* called *Pyramidales* or *succenturiati*, that is, spirie or assistant muscles were ordained by Nature to further the excretion of this humour, and therefore both these actions are mixed.

The vrine.

Obiection. Answered out of Galen.

Some will obiection that excretion can be no way naturall, because all naturall actions being perpetuall and indefinent the vrine should bee continually auoyded. *Galen* answereth that all vrine is not the obiection of the expulsive faculty, but that onely which either fretteth or stretcheth, that is, which is offenseue either in quantity or in quality: and so much concerning the Bladder: now follow the Paps.

QUEST. XXII.

Of the action and vse of the Breasts or Paps.

The question.

LI men I thinke are resolved that there is in the Breasts an in-bred faculty of making Milke. This onely is questionable, how they which are but kernels should performe an officiall or common action, which is accomplished by alteration &

con-

concoction; seeing *Galen* denyeth vnto these glandules all action and yeeldeth vnto them onely a vse. Now that the Breasts or Paps are to be reckoned among the glandules, their substance and vse doe manifestly declare. For their substance it is rare, friable, and spongy; and for their vse *Hippocrates* in his Booke *de Glandulis* ascribeth the same vnto the Dugs which other kernelly parts performe, where he saith, *The Vses of the paps and of the Glandules before mentioned are alike, for they all sucke vp the superfluities of the whole bodie.*

For the Solution of this Question, we say there are two kindes of Glandules, for which we haue *Galen* our Author, in his second Chapter of the sixteenth Booke of the *vse of parts*. There are some Glandules which are ordained onely to establish and vnder-prop the Vessels, or to receiue superfluous humors, or to water and moysten the parts. There are others which are provided by Nature for the generation of certaine iuices or humors which are profitable for the creature. The former haue neyther Veines, nor Arteries, nor sinnewes: these latter haue very conspicuous vessels, and are of exquisite sense. The former are properly called Glandules; the latter may better be stiled Glandulous bodies. So the Testicles and the Kidneyes by *Galen* are called Glandulous bodies; and *Hippocrates* in his Booke *de Glandulis* saith, that the braine it selfe in respect of his substance is glandulous. The former are onely of some vse, the latter affoord both vse and action, amongst which wee conclude the dugs or breasts to be.

And whereas *Hippocrates* saide, that these dugs doe receiue or suck vp an excrementitious humor, we vnderstand that this is not their primary or chiefe & maine vse, but only secondary: for Nature often abuseth one and the same part to diuers vses, so the braine in manner of a *Glasse, still, or Cucurbita*, doth draw and sucke vp the expirations of the lower parts, and yet notwithstanding there is another and more diuine vse of the braine. So nature often abuseth the guts for the expurgation and vnburdening of the whole body, whereas they were originally ordained for another purpose, to wit, for distribution of the Chylus.

The Breasts therefore or Paps haue a proper action and vse. Their action is the generation of Milke, which is performed by a moderate and equall coction or boyling. Their vses are either primary or secondary: The primary vse *Galen* saith is for generation of milke, but *Aristotle* would haue them ordained for the defence of the heart, the most noble of all the bowels, and I thinke he was misled with this argument, because men had breastes, and yet did not ingender milke. Wee with *Galen* do determine, that these glandulous bodies, compassed with fat, and wouen with many thousand vessels, were first and originally ordained for Milke, and are not alike in men and women. And yet I conceiue that they were scituated in the breast rather to add strength to the noble parts contained vnder them, then for the generation of Milke. For in most creatures they make Milke not in the breasts but in other parts.

You shall therefore reconcile *Galen* and *Aristotle*, if you say, that the Dugges were created originally for the generation of Milk, and secondarily for the strengthening and defence of the heart. And againe, that the originall cause of their scituation in the breast was for the defence of the heart, and the secondary for the generation of milke.

QUEST. XXIII.

Whether Milke can be generated before conception.

It was disputed of old, and is yet a question amongst the multitude, whether Milke can be engendred in a womans breasts before she haue had the company of man and conceyued. And this doubt is occasioned by some different places in *Hippocrates* and *Aristotle*. *Hippocrates* in his first Booke *de Morbis mulierum*, inquiring after the signes of the *Mola* or Moon-calfe, reckoneth this as one of the principall, *When in the Breasts there is no Milke engendred*. And therefore the generation of Milke is according vnto *Hippocrates* a certaine signe of conception. *Aristotle* in his Bookes *de Historia Animal*, confirmeth the same, where hee saith, *That no Creature engendred Milke before the womb be filled.*

And reason seemeth to consent with their authority. For if nature do neuer endeavour any thing rashly, but all things for her proper end, what neede is there of Milke before the infant be perfected, it beeing only ordained for the nourishment thereof? Notwithstanding *Hippocrates* in his Aphorismes seemeth to be of a contrarie minde. *If a woman (saith he)*

The solution
of the question
Galen.

Two kindes.

Galen.
Hippocrates.

Hippocrates ex
pounded.

The braine
Glandulous.

The primarie
vse of the
breasts.

Galen.
Aristotle.

Galen.

Galen and *A*
ristotle recon
ciled.

Hippocrates.
Aristotle

Hippocrates,
which

which is neither big with child, nor hath yet conceyued, haue milke in her breasts, it is a signe that her courses are stopped. And Aristotle in his Bookes de Historia Animal: affirmeth, that Milke may be bred in the breasts or dugs of men, which also Albertus and Auen do witnesse.

A storie out of
Cardanus.
The men of
America haue
milke in their
breasts.

Reasons.

Hippocrates.
A reconciliati-
on out of Hip.
Two kinds of
milke accord-
ing to Hip.

Hippocrates.

How the milke
commeth vnto
the breasts,
and why.

Hippocrates.
The first ge-
neration of
milke.

Hieronimus Cardanus in his Bookes de subtilitate saith, that hee saw a man about thirtie foure yeares old, out of whose breasts so great a quantity of Milke did flow, that it was almost sufficient to nourish a childe. They that haue trauailed into the new world do report that almost all the men haue great quantity of Milke in their breasts.

If therefore men doe breede Milke, much more Virgins, and Women before they doe conceiue. For their Dugs are more rare and large, and beside they haue a greater abundance of superfluous blood. Reason also fauoureth this opinion, for where the materiall cause of Milke is present, and the strength of the efficient not wanting, what should hinder the generation thereof? Now in Virgines that bee of ripe yeares, the veines of the Chest which water the Dugges haue great abundance of blood, they haue also the strength of the glandules to alter and to boyle it: for after the fourteenth yeare, The Dugges sayth Hippocrates doe swell and the Nipples strut, and young wenches are then sayd *ruqizant*, that is *frigate*. Wherefore Milke may sometimes be bredde, in such women especially whose courses be stoppt as Hippocrates writeth. But these disagreeing places of Hippocrates it wil not bee hard to reconcile out of Hippocrates himselfe. There is a double generation of Milke according to Hippocrates, and a double nature thereof. One kinde of Milke is true and laudable, another not true nor perfectly boyled. The former is made by a great alteration and true concoction of the breasts, and that not priuate but officiall; the latter riseth of a remainder of proper nourishment of the breasts, the first is perfectly white, sweete, and moderately thick, & fitte to suckle an Infant; this other is white indeed because it beareth the colour & forme of the part from whence it floweth, but it hath neither the true nature of a nourishing Chymus or humeur, nor the sweetnes nor the power or vigour of nourishment, and therefore it deserueth the name of Milke, not by his quality or specificall forme, but onely for his colour, for it is thinne and waterish, altogether vnprofitable to nourish an Infant. The former is begotten by the expression and refluxence of the blood from the womb to the dugges, as also by traction: this latter onely by the Traction of proper Aliment; the former cannot be generated before true conception, because there should be no vse of it before. The latter may bee ingendered in growne and ripe maydens, and well blooded men, whose bodies and vessels do abound with laudable iuices. This double kinde of generation of Milke, I gather out of Hippocrates his Bookes de natura pueri & de glandulis. The Nature, saith he, of womens breasts is very rare and spongy, and the Aliment which they draw vnto themselves they turne vnto Milke. This is the later kinde of generation.

The other he describeth in the same place. The Milke commeth from the wombe to the breasts, which after the birth must be the nourishment of the Infant: this the Kel presseth out and sendeth upward, being straightned by the growth of the Infant. Wherefore the blood is pressed or strayned, and so returneth in women with Child by a wonderfull prouidence of Nature from the wombe to the Pappes, and that as soone as the Infant begins to moue. After it is brought into the world there is no more expression made, but the blood floweth of it owne accord to the Pappes, according to his accustomed motion, which Hippocrates sheweth in these words, in his Booke de natura pueri. After a woman hath borne a childe, if shee also haue giuen sucke before, the Milke will arise into the breasts as soone as the Infant begins to moue: so that after the birth it is therefore led vnto the breasts, because it was accustomed to bee his course that way all the while the Infant did moue in the mothers wambe. Neither doth the blood onely of it owne accord presse vnto the Pappes, but they also drawe a greater quantity then is sufficient for their particular nourishment.

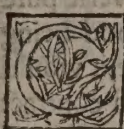
Of this Traction there bee diuers causes: the Infants sucking, the largenesse of the vessels, the motion or exercise of the dugs, and at length the auoyding of vacuity. For when the veines of the breasts are exhausted by the Childs instant sucking, then they draw blood vnto themselves from every side.

Wee conclude therefore that true Milke and perfectly concocted, is not generated before conception, but that there may be a thinne and raw Milke sometimes made of the reliques of the proper nourishment of the dugs.

QUEST.

QUEST. XXIII.

wherein certaine Problemes are vnfolded concerning
the generation of Milke.



Concerning the first generation of Milk, there is vpon record a solemne edict of Hippocrates in his Booke de natura pueri. As soone as the Infant beginneth to moue, the milke giveth warning thereof vnto the mother. For the explication of which sentence, there are two Problemes to bee discussed. The first, why at that time the Milke should begin to be generated. The second, why the infant should be nourished out of the wombe with the same wherewith hee was nourished in the Wombe. The resolution of the first question will haue some difficult passages in it. For seeing that the Milke is onely ordained for nutrition, and that therewith the infant in the wombe is not nourished, but onely after the birth, why is the Milke generated before the 7. month, til when there is no vse of it, or why doth it not flow from the womb to the breasts presently, or soone after conception as well as in the third and 4. months. Hippocrates in the booke before quoted, answereth this Question thus, *That the infant in the third or fourth month becoming great, dooth straine or presse the vessels which are full of blood, and by this compression there is an expression made vnto the upper parts.*

This reason is indeede very true, but verie subtile and obscure, wherefore we wil paine our selues a little to make it manifest. In the first months, Natures expence of blood is verie great. First of all, because the Parenchymata or substance of the bowels and all the fleshy parts are generated, and afterwarde for the nourishment and growth of them all, so that there remaineth little or no ouerplus of the Mothers blood. But when the infant begins to moue because there is already a perfect conformation of all partes, Nature thereafter onely intendeth nourishment, which nourishment requireth but a small quantity of Aliment, because there is but small and slender exhaustion or expence in the parts, and therefore in the veynes of the Wombe, there must needs be an ouer-plus of blood: These Veines being pressed by the motion & weyght of the Infant, which now is growne great, doe driue the blood vnto the vpper parts, and rather into the Dugges then into any other, as well because of the commodiousnesse and fittnesse of the way, as because of the societic and simpatie that is betwixt the wombe and the breasts. Add hereto a third cause which also is the finall, and that is the wonderful prouidence of Nature, whereby the blood is accustomed by little and little to be transported vnto the place where it shall be turned vnto Milk, and so remaine a plentiful fountaine for the nourishment of the infant after it is borne into the world.

And that is the reason why women are not so much troubled with bleedings at the nose, and with Hamorrhoides, because blood affecteth the way vnto the wombe, to satisfy the ende or intent of Nature, which is the generation and nourishment of an infant. Giue mee leaue also to giue another reason of this refluence of blood from the Wombe vnto the Dugges, which is, That the infant might haue occasion offered it to seeke a way out of the Wombe. For, if all the blood were still reserved in the vessels of the wombe, and no part of it discharged or sent away other whither, the Child would neuer strue to come forth, hauing alwayes nourishment enough at hande to content it: for Hippocrates saith, that the chiefe cause of the strife of the Infant in the byrth is the want of Nourishment.

It behooued therefore, that in the thirde and fourth Moneths Nature should by degrees transferre the blood vnto the Dugges to accustome her selfe to leade it thither for the nourishment of the Infant when it is borne, as also to defraud the infant (now becom'd better growne) of his nourishment, whereby hee might bee prouoked to seeke for it otherwhere. Some thinke, that the blood returneth vnto the breasts after the infant begins to moue, to bee kept as it were in store, that thereby at time of neede and in great want the infant might haue blood so prepared and whitened into Milke to sustaine his necessity.

And this Hippocrates seemeth to intimate in his Booke de Natura pueri, where he saith, *That the infant with this milke, is somewhat & sometimes nourished,* which saying of Hippocrates I do thus interpret, *The child is nourished with milke,* that is, with the blood conteyned in the veines of the dugs, which is the next and most immediate matter of the milke, or, if the infant should bee extreemly affamished before the time of the birth, I thinke that the

why the milke
is generated
the 3 or 4.
moneth.

Question.
Hippocrates
Solution.

A darke sen-
tence of Hipo-
crates ex-
plained.

Why the
blood retur-
neth from the
wombe rather
to the Dugges
then to any o-
ther part.

The prou-
idence of Na-
ture.

Why women
bleed not at
the nose, nor
are troubled
with the
Hamorrhoids.

Hippocrates.
The true
cause of the
trauel.

Hippocrates
pounded.

white milke may turne from the Paps to the vessels, and be there boiled and conuerted into blood by the sanguifying vertue of the veines, which is neuer idle or asleepe. And that the milk may returne from the paps vnto the vessels, and be againe altered into blood, is approoued by the daily experience of nurses and women in child-bed.

The second
probleme.

Dinus answer.

Another an-
swer.

Obiection.

Answer.

The conclusi-
on of these
controuersies.

The second Probleme was, why the Infant is not nourished with the same Aliment without and within the Wombe; for within the wombe it is nourished with verie pure blood, without the wombe with sweete milke. *Dinus* answereth, That the blood being hotter then the Milke, if it should passe all the three concoctions in a childs bodie, it would at length become vnmeet for nourishment, because by too much heate it would contract a bitternesse: but the Milke which is of a more cold temper is more easily mittigated, and groweth rather sweet then bitter by the threefold concoction. But is it rather an inhumane and beastly thing for children to be blood suckers: or shall we say that therefore the Infant after byrth is not nourished with blood, least by his sucking hee should open the mouths of his Mothers Veines, and so the blood which is the treasure of nature should flowe away?

And whereas some affirme, that after wee are borne, it is necessary that our Aliment should passe all three concoctions, and that it is not possible that the stomacke should chy- lific the blood, and therefore Infants are not nourished by blood but by milke: I say the reason is false and full of error, for whatsoeuer is taken vnto the stomacke, if it may be assimilated, it may also be turned into a creamy substance, and many there be who drinke the blood of Swine and Goats, the noysome excrements whereof are auoyded by the guttes and the seidge. Now the excrements of the guts, are onely excrements of Chylification.

Other things which may concerne this or anie other of the Naturall parts which be- long vnto Nutrition, because wee imagine that they are easilie knowne, or if hard yet ge- nerally agreed vpon, we do willingly passe ouer, iudging it sufficient that we haue thus long detained the Reader in these Labyrinthes of Controuersies, which notwithstanding as (it may be) they will not be thought necessary for all, so we presume that they will not be irkesome to any man, whose Stomacke standeth to these delica- cies of Nature, nor vnprofitable for those to whose proper element they belong. Now it is high time to returne to our

Anatomicall History of the Natu-
rall Parts belonging to
Generation.

The end of the Controuersies of the third Booke.



Of the Naturall Parts belonging to generation, as vvell in Men as in Women.

THE FOURTH BOOKE

The Preface.

BEing arrived at this place in the tract of my Anatomicall Peregrination, I entred into deliberation with my selfe, whether I were best silently to passe it by, or to insist vpon it as I had done in the former. On the one side I conceiued my labour would be but lame if it wanted this limbe, and a great part of my end and ayme frustrated, it being to exhibite the wonderfull wisdom and goodnesse of our Creator, which as in all the parts it is most admirable, so in this (if perfection will admit any degrees) it is transcendent. The whole body is the Epitomie of the world, containing therein whatsoeuer is in the large vniuerse; Seede is the Epitomy of the body, hauing in it the power and immediate possibility of all the parts. Moreouer, the knowledge of these principles of generation is so much more necessary toward the accomplishment of our Art, by how much it is more expedient that the whole kinde should be preserued then any particular. Adde hereto, first that the diseases hence arising, as they bee most fearefull and fullest of anxiety especially in the Female sexe, so are they hardest to be cured: the reason I conceiue to be, because the partes are least knowne as being veiled by Nature, and through our vnseasonable modesty as it is called, not sufficiently discovered. Againe, the examples of all men who haue vndertaken this taske euen in their mother tongues did sway much with me whose writings haue receiued allowance in all ages and Commonwealths. On the contrary there was onely one obstacle, to reueyle the veile of Nature, to prophane her mysteries for a litle curious skilpride, to ensnare mens minds by sensual demonstrations, seemeth a thing liable to heavy construction. But what is this I pray you else but to Araigne Vertue at the barre of Vice? Hath the holy Scripture it selfe (the wisdom of God) as well in the old Law particularly, as also in many passages of the new, balked this argument? God that Created them, did he not intend their preservation, or can they bee preserued and not knowne? or knowne and not discovered? Indeede it were to be wished that all men would come to the knowledge of these secrets with pure eyes & cares, such as they were matched with in their Creation: but shall we therefore forget our knowledge because some men cannot containe their lewd and inordinate affections? Our intention is first and principally to instruct an Artist: secondarily that those who are sober minded might knowe themselves, that is, their owne bodies, as well to giue glory to him who hath so wonderfully Created them; as also to preuent those imminent mischiefes to which amongst and aboue the rest these parts are subiect. As much as was possible we haue endeouored (not frustrating our lawfull scope) by honest wordes and circumlocutions to molifie the harshnesse of the Argument; beside we haue so plotted our busines, that he that listeth may separate this Booke from the rest and reserue it priuately vnto himselfe. Finally, I haue not herein relyed vpon my owne iudgement, but haue had the opinion of graue and reuerent Diuines, by whome I haue bin perswaded not to intermit this part of my labour. My hope therefore is that my paynes in this part shall receiue not onely a good construction, but also approbation and allowance of all those that are indeed wise.

As

Arguments
perswading vs
to prosecute
the history of
these parts.

Obiection an-
swered.

How caute-
lous we haue
beene herein.

As for such as thinke there is no other principle of goodnesse then not to know euill, I would wish them to learne of their horses, that it is no good Manage to stand stocke still but to moue in order. We will apply our selues to our businesse.

The perfecti-
on of euerie
thing is per-
tuity.

What life is:

Comparison.

The greatest argument of diuinity, or of a nature relishing thereof is perpetuie and immutability, the perfection whereof as it is incompetent to any compound creature (for the soule is therefore immortall because it hath no parts) so it is most resembled in that we call *Life*; wherein there is a perpetuity though not of all the parts of time *Past*, *Present*, and *to Come*; (for Time is the measure thereof) yet of that which in time is subsistent, that is, the *Present*. For as the production of poynts perpetueth a line, so the coherence of *present* times make a kinde of eternity. Life therefore so long as it is prolonged hath no end, and may be compared to a clew of yarne, such as the Poets feigned Destinies to spin, which so long as there is flaxe to supply, may be drawne into an endlesse length. Now wee must know that the matter of all things is eternall for it neuer perisheth, else had the world long agoe beene annihilated. The dissolution of created things is but a resolution of one thing into another; hence comes the perpetuity of all things though subiect to alteration, a perpetuity I say, not of the same particular thing distinguished by one and the same *forme*, but of the Elementary parts whereof it was compounded.

The Element-
ary forme of
man.

How a man is
perpetuall:

The proceffe
of Nature in
the Frame of
man:

Comparison:

But some will say, this is but a speculatiue and imaginary perpetuity, shew it vs more really that we may see it with our eyes, & feel it with our hands. I shew it thus. The body of man consisteth of the matter and forme; by forme I mean, not the soule, but the forme subsisting in the matter, and arising out of the power of the same, which though it be not diuine nor aetheriall as some imagine, but meere materiall, yet so neere it approacheth to the puritie and nature of the first matter whereout it resulteth, that it easily vanisheth into an uncompounded principle, subsisting afterwards in Nature, not as a *forme*, being forsaken by the spirite wherein it had his residence and whereby it was nourished, but as a part of the vniuersall Nature.

This forme we call *Life*, which as it is raised out of the matter of the body, so it continueth so long therein, as it is supplied with nourishment, which nourishment is the radical moysture of the spermatie parts. Nature therefore being not able to generate anie part of seede whose moysture shoulde not in time bee exhausted, could not produce any particular creature eternall or immutable: notwithstanding she deuised a way by framing parts fit for multiplication of seede, to raise a perpetuity, though not of any particular *indiv-
duum*, yet of the *kinds* of all creatures. Those parts are the subiect of our present Discourse.

So then first of all she prepareth a matter euen the ouer-plus of the nourishment of the particular parts of our bodie. For the nourishment hauing arriued at the parts, and receiued an impression or stampe of their nature, is partly assimilated into their substance, part (at least if there be any ouer-plus when the part is satisfied) falleth backe by the Vesselles vnto the spermatie Veines and Arteries, which receiuing an irradiation from the Testicles to which they are continued, do giue that matter a kinde of Rudiment of seede. The lower it falls and the nearer it approacheth to these Testicles, the better is it still laboured, till in the end it receyue from them his vtmost perfection both in the colour, consistence, and prolificall vertue; being so accomplished, it is conueyed by the leading vessels into the Store-house called *Prostate*, where it is tunned vp and reserued for the generation of a new creature, which new creature when it is made, is also able to afforde matter for the generation of another, and so nature obtained a perpetuity and eternity euen out of mutable and temporary principles.

The like administration of Nature (though the proceffe of her worke bee not so long) we see in fruites, trees and plants, all of them being able to bring forth seede, which shall perpetuate their kindes; a seede (I say) which though it bee but small, shall containe in it a power to frame anew all the parts of the bodie from whence it yssued. So an Acorne hath in it the power of a mighty Oake. The quantity of an Emmet of seede, the power to grow into a vast Elephant. But because whattoeuer is ordained to bee made a liuing creature, must haue not onely one principle whereof it should bee formed, but also another whereby it might bee sustained and nourished, as also a conuenient place for the growth and extension thereof: Nature therefore (vnder which name I alwayes vnderstand the wise administration of almighty God) made another sexe of mankind, not altogether of so hot a temper or constitution, because she shoulde haue a superfluity of blood for the nourishment of the infant, as also that the partes of generation for want of heate to thrust them forth

foorth remaining within, might make a fit place wherein to conceive; breed and perfect the same.

why woman was made.

Againe, that there might bee a mutuall longing desire betweene the sexes to communicate one with another and to conferre their stocks together for the propagation of mankind, beside the ardor and heate of the spirits conteyned in their seeds, the parts of generation are so formed, that there is not only a naturall instinct of copulation, but an appetite and earnest desire thereunto, and therefore the obscene parts are compounded of particles of exquisite sense, that passion being added into the will, their embracements might be to better purpose. As for the particulars it shall be in vaine in this place to make mention of them, because the following discourse shall at large decipher them vnto you, in which we will first describe the parts of generation belonging to men, and then proceede to those of Women also; of which wee would aduise no man to take further knowledge then shall serue for his good instruction. And so we descend vnto our history.

The nature of the obscene parts.

Man's nature.

CHAP. I.

Of the Necessitie of the parts of Generation.

It is a ruled case in Hippocrates his Bookes de dicta, Aristotles Booke of the length and shortnes of Life, Galens first Booke de sanitate tuenda, and at a word amongst all Philosophers and Physitians: That all things vnder the Moone which is (sayth Cicero Somnium Scipionis) ultima Caelo citima terra, the last in Heauen and the nearest to the Earth; all thinges I say conteyned within the Elements are subiect to corruption and dissolution. For every singular and particular thing either hath life or is without it: if it be without life it is obnoxious to diuers alterations, in regard both of the first and second matter whereof it consisteth. For the first matter, it is alwayes in loue with new formes; and therefore most subiect to mutation, which the French Poet Salust expresth vnder the comparison of a notorious Strumpet, on this manner.

All Elementary things mortal, and how they are corrupted.

Salust du Bar.

Or like a Lais, whose vnconstant loue
Doth every day a thousand times remoue
Who's scarce vnfolded from one youths imbraces,
Yet in her thought another shee imbraces:
And the new pleasure of her wanton fire,
Stirs in her still another new desire.

The generall matter of things like a strumpet.

The second matter which consisteth of the Elements, because of their intestine discord (for they are contraries, and from contrariety comes all corruption) vrgeth continually the dissolution of the mixed body.

The Elements themselves whilst they are out of their proper places, although they bee naturally linked together, yet it is not without a kinde of violence and constraint, and therefore doe instantly long to retorne into their proper seates.

But if the body be animated and haue life, beside those already named, it hath also other causes of dissolution bred within it, which no art, no industry of man can auoyde, no not so much as repress: so all things which haue any kinde of life, especially liuing and mouing creatures are destined to corruption, by Nature and necessity. By Nature because of the exhaustion or expence of the Primigenie moysture by the Elementarie heat and the continuall effluxion of the threefold substance. By Necessity because of the permixtion of the Aliments and the increase of excrements, the suppression whereof maketh an oppression of the parts, stableth vp a fruitfull nursery of diseases, and finally introduceth death it selfe.

A double destiny.

By Nature.

By Necessity.

Wherefore Nature whome Hippocrates calleth τὰ δέοντα ποιῶσα Recta facientem, and the ordinary power of God, being a diligent and carefull provider for her selfe, hath giuen to euery thing a certaine appetite of eternity, which because shee could not performe in the Individuum or particular Creature, because of the mortality of their Nature, she induceth to accomplish by propagation of formes and the species or kinds of things; as in the Elements by transmutation of one into another, in Minerals by apposition, and in Creatures by Generation. For so euery individuum extending it selfe as it were, in the procreation of another like vnto it selfe, groweth young againe and becommeth after a sort eternall. The

Lib. Epidem. The providence of Nature, or rather of the God of nature. An image of immortality.

father

Removeth
John 12. 1.

The generation
of perfect
Creatures.

Naturall plea-
sure in genes-
ration.

The parts of
generation in
men.

The parts of
generation in
men.

father liueth in the sonne, and dyeth not as long as his expresse and liuing Image stands vp-
on the earth.

To passe by the production of other things, the generation of perfect creatures is ac-
complished when the male soweth his seede, and the female receyueth and conceyueth it.
For this purpose Nature hath framed in both sexes parts and places fit for generation: be-
side an instinct of lust or desire, not inordinate such as by sinne is super-induced in man, but
naturall residing in the exquisite sense of the obscene parts. For were it not that the God
of Nature hath placed heerein so incredible a sting or rage of pleasure, as whereby wee are
transported for a time as it were out of our selues, what man is there almost who hath anie
sense of his own diuine nature, that would defile himselfe in such impurities? what woman
would admit the embracements of a man, remembering her nine moneths burthen, her
painefull and dangerous deliuerance, her care, disquiet and anxiety in the nursing and e-
dication of the infant? But all these things are forgotten, and wee ouertaken with an ex-
tase, which Hippocrates calleth a little *Epilepsie* or falling sicknesse: and the holy Scripture
veilith vnder the name of a senselesnesse in Lot, who neyther perceiued when his daugh-
ters lay downe, nor when they rose vp.

Well, the History of these parts of generation it is our taske in this Book to describe, ouer
which also we could wish we were able to cast a veile, which it should bee impiety for any
man to remooue, who came not with as chaste a heart to reade as wee did to write. How-
euer, that which must needs be done, shal be done with as little offence as possible we may.

The parts therefore of Generation are of two sorts, some belong to men, some to women.
The parts of Generation belonging to men (for of the other we shall see afterwards) are
verie many, but all conspiring vnto one end, which is to exhibite something out of them-
selues which may haue the nature of a Principle; by which, and out of which a newe man
may be generated. The Principle exhibited is seed, which because it containeth in it selfe
the forme and Idea of all the parts (for it falleth from them all) and beside *μὴ ἴσως περὶ αὐτῶν*,
that is, the fatal necessity of life and death, stood in neede of manifold preparation, coction
and elaboration, and therefore the structure of the parts fit for so great and curious a worke
is no doubt very exquisite. For some of them do onely prepare the seede, or as it were
rough hew it, as putting thereon a rudiment of seed, which before was nothing else but an
ouerplus of the purer part of blood remaining after assimilation in the particular parts of
the bodie.

This preparation is made in the spermatieall Veines and Arteries, whose admirable im-
plications and complications like the wretched or wormie tendrils of veines, do forme as it
were a twisted or bedded net, wherein the matter is so long retained, till it acquire some
beginning of alteration from that it was before. Other parts there are which boyle it anew,
as that we cal *Epididymis* or *Parastata*, others affoord vnto it prolificall vertue, whereby it
is enabled to produce and generate a thing like vnto it selfe, & those are the testicles which
giue it the true forme of seede; others, when it is thus perfected, leade it downe toward the
place of receipt which are called *Deferentia* or *Eiaculatoria vasa*, albeit I see no great rea-
son for the second name, wee call them the *Leading vessels*. Others receiue, containe, and
store it vp for necessary vse as the many vesicles or bladderets, and those Kernels or Glan-
dules which are called *Prostata* scituated at the necke of the bladder of vrine. Finallie, o-
thers deliuer it out, and strew it in the seede plot, sowe it in the fertile field of Nature the
wombe of the woman; which is called *penis* the yard or virile member. Of all which, if but
one bee wanting, yea defectiue, the worke of generation goeth not at all or but lamely for-
ward, wherefore we will endeouour to shew you the naturall both position, disposition, and
vse of euerie one in their proper places.

CHAP. II.

Of the preparing spermatiecke or seede vessels.

Two sorts of
seede vessels.

Preparing:



THE first Instruments of Generation, are called *vasa spermatica*, the spermatiecke
vessels. These are larger in men then in women, and they are of two sortes,
Praparantia or *Deferentia*, Preparing or Leading vessels. The Preparing Ves-
sels [Tab. 2. 1. x. 2. tab. 1. 0. q. 1.] which are called *παραιωστικα* by Galen, by Au-
scen *vasa Lumbaria*, are foure. Two veines [Tab. 1. 0. q. tab. 2. 1. x.] and two Arteries, on each
side



side one [table 1, r, table 2, u.] The right veind ariseth [table 1, r, table 2, u.] a little below the originall of the emulgent [table 1, h, table 2, m, n.] from the vpper and forward part of the trunk of the hollow veine; as it weie with a long and thick knob or knot [table 1, p, table 2, a] (to which as *Galen* obserued, a certain small branch is conuayed from the emulgent) that it might afford more pure and better concocted blood.

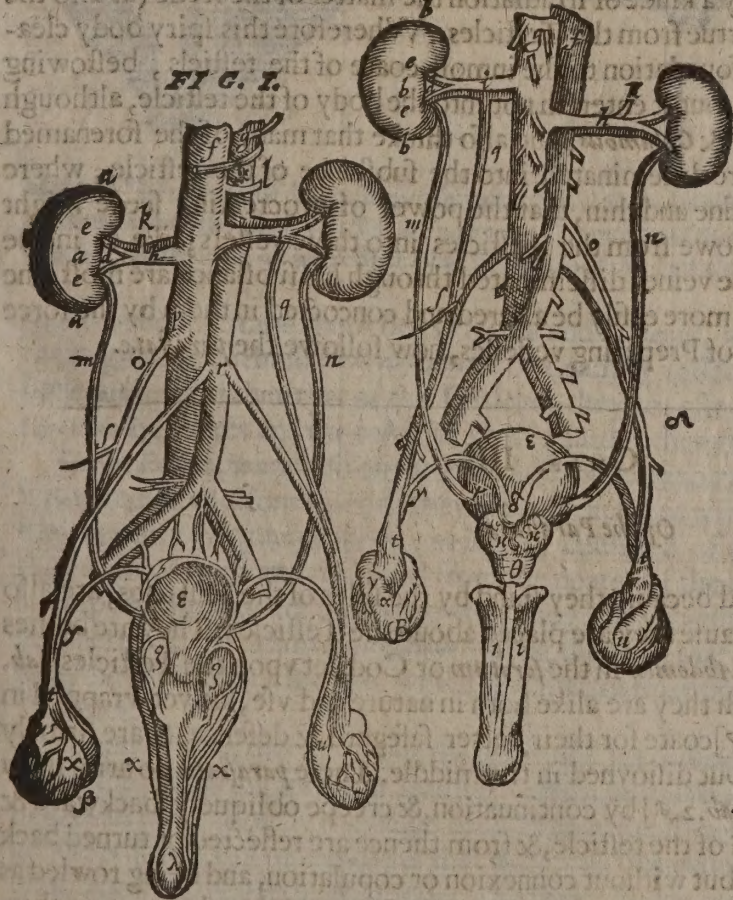
The left [table 1, q, table 2, x.] ariseth not from the trunk of the hollow veine, but from the lower part of the emulgent; for if it should haue risen from the same place in the hollow veine where the right seede-veine arose, it must necessarily haue gone ouer the great arterie [table 1, g.] by the continuall motion of whose *systole* and *diastole*, that is, elevation or distention, and depression or contraction, being final, it would haue been either broken or much hindered from performance of his proper office, or else haue intercepted or offended the Arteries; both which inconueniences are auoyded by his arising, as we haue sayed out of the lower part of the left emulgent: [Table 1, i, table 2, u.] yet hath it sometimes a small branch reached vnto it from the trunk [table 2, v.] of the hollow veine; the blood also it brings is more *serous* then that of the right spermaticall veine.

The two Arteries arise neare one another [table 1, r, table 2, u.] out of the middle trunk of the great arteries a good way beneath the emulgents; that they might bring thinner and better cleansed or defecated blood. The right spermaticall Arterie climbing ouer [table 1, figure f.] the trunk of the hollow veine hastneth obliquely to the seede veine; the left closely accompanieth the veine of his owne side. And this Arterie we haue seene sometimes absent; and then the left seede veine is so much the larger; otherwise, generally these arteries are larger then their veines; because it was necessary that many vitall spirites and

Table 1, Lib. 4. sheweth the Kidneyes with the vessels of urine and of seede; a part of the Hollow veine and also of the great Arterie, the Testicles, the bladder, and the yarde. The first figure sheweth the fore-side, the second the hinder side.

TABVLA XXII.

FIG. II.



- aaa 1. The fore part of the right kidney.
 bbb 2. The back part of the left kidney.
 c 1. The outward side.
 dd 1, 2. The inner side.
 e 1, 2. The two cauities whereinto the emulgent vessels are inserted.
 ff 1, 2. The trunk of the Hollow veine.
 gg 1, 2. The trunk of the great artery.
 hh 1, 2. The emulgent veine & artery.
 ii 1, 2. The right fatty veine.
 j 1, 2. The left fatty veine.
 k 1. The Celiacall artery.
 m n, 1, 2. The vreters.
 o p q, 1, 2. The right spermaticall veine which ariseth neere p, the left neere q.
 r 1, the place where the arteries of the seede do arise.
 s 1, 2. Small branches distributed from the spermaticall veines to the Peritonaeum.
 t 1, 2. The spiry bodden bodie, called *Varicosum vas pyramidale*.
 u 1, 2. The *Parastata* or *Epididymis*.
 x 1. The testicle covered yet in his coate.
 y 1, 2. The place where the leading vessel called *Vas deferens* doth arise.
 z 1, 2. The descent of the same leading vessel.

leading vessel. 1 1, 2. The passage of the same vessel reflected like a recurrent nerve. 2 2. The meeting of the same leading vessels. 3 1, 2. the bladder of Urine, the first figure sheweth it open, the second sheweth the back parts. 4 1. The final bladder of seede opened. 5 1, 2. The Glandules called *glandula prostatica*. 6 2. The sphincter Muscle of the bladder. 7 1, 2. The two bodies which make the substance of the yarde. 8 1. The vessels which go vnto the yarde, and the necke of the bladder. 9 1. The passage which is common to the vrine and the seede, cut open. 10. The implantation of the vreters into the bladder.

Veines.
The right.

The left.

The great
providence of
Nature.

Arteries.

A great cause
of barrennes.

The course of
the Sperma-
ticke vessels.

The spirie
boddin body.

The vse of the
Spermatike
vessels.

Vesalius.
Columbus.

much arteriall blood, should be conuayed to the Testicle, that when the seede is perfected, it might be fulfilled with spirit and vitall heate. It is obserued also, but more rarely, that in some bodies both the Arteries are wanting; and happely it falleth out so in them that are barren, for why there is no source of vitall spirits falling vpon their testicles.

All these vessels, the right veine with his Artery, and the left with his, not much parted one from another [Tab. 3. figure 2. 00] do beare vpon the *Peritonaeum*, and proceeding downward, are ioyned together with fibrous ties, [tab. 3. fig. 3. NN] and so passe along obliquely about the Vreters [tab. 1. fig. 1. mn. tab. 2. qq] allowing by the way certaine small branches [tab. 1. f. tab. 2. 0] to the *peritonaeum*, thorough whose productions (which firmly grow to their sides [tab. 2. 7. tab. 3. A] at the groin) they make way, together with a small nerue of the sixt paire, and the Cremaster Muscle [tab. 2. 4] and so far to the *Parastata* [tab. 1. u. tab. 2. 5] and to the vpper part of the Testicle, where the Veine & the Artery mixing together, do fashion out betwene them one body like a *pyramis* [tab. 2. from d to e] or spire depressed and plaine on each side. This bodie, because of the innumerable branches of Veines and Arteries ioyned by *Anastomosis* or inoculation, of which it is wouen as it were into a platted web, is called in Greeke *νεφροειδὲς παρὰ δῆς* by *Galen* in his booke de *Semine*, in Latine *Corpus varicosum* [tab. 1. 1. tab. 2. 8. tab. 3. Fig. 2. u. Fig. 3. C. sheweth the beginning of it, and D. the basis or foundation] the boddin bodye, and from the fashion of the tendrils of Vines *pampine-forme*, we may call it the *spirie boddin or embossed body*, to distinguish it from the *Parastata*, which are also called *corpora varicosa* or boddin bodies. [tab. 1. u. tab. 2. 6].

The vse of these vessels is not onely to leade downe blood of both sorts, Venall and Arteriall, together with vitall spirits for the nourishment and life of the Testicles; but also to receiue a matter or substance which falleth from al parts of the body; (the last and most perfect superfluity of the Aliment) some-what to alter it, and so to conuey it to the *parastata* for the generation of seede.

Moreover about the middest of these vesselles, the blood hath his first beginning of *dealbation* or whitening, yea, and a farther preparation also in those textures and webbes of which we lately spake, wherein by a kinde of irradiation the matter of the seede (as also the textures themselves) receyue vertue from the Testicles. Wherefore this spirie body cleaueth, yea groweth at his *basis* or foundation to the inmost coate of the testicle, bestowing vpon them certaine small furcles, but it entereth not into the body of the testicle, although some would haue it so, as *Vesalius* & *Columbus*, who also thinke that many of the forenamed branches do passe through, and are disseminated into the substance of the testicle, where their coates become exceeding fine and thin, that the power of procreating seede might the more suddenly and at once flowe from the Testicles into those vessels; like as in the Liuer the tunicles or coates of the veines disseminated through his substance are most fine and subtile, that the blood might more easily be altered and concocted in them by the force of the *parenchyma*. And so much of Preparing vesselles, now followe the *parastata*.

CHAP. III.

Of the Parastatae.

Their situation.

Their originall.

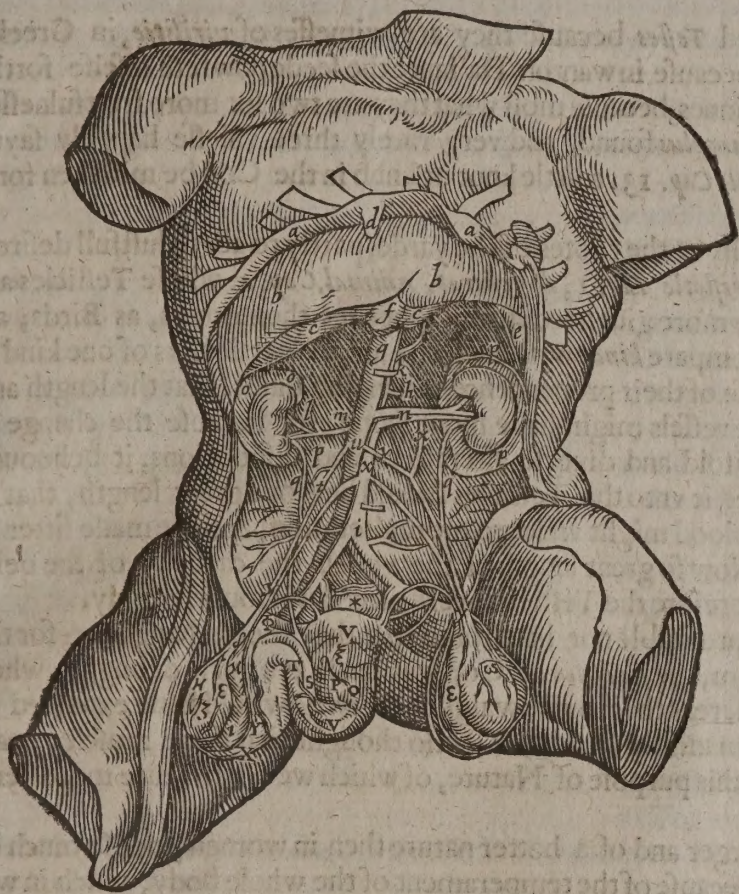
Galen.

Their forme.

THE *Parastatae*, so called because they stand by the sides of the Testicles, are also called *νεφροειδῆς*, because they are placed about the Testicles. They are bodies situate without the *Abdomen* in the *scrotum* or Cod, set vpon the Testicles [tab. 1. 11. tab. 2. 6] (to which they are alike both in nature and vse,) as yet wrapped in their inmost [tab. 1. fig. 1. x. tab. 2. 7] coate for their better safegard & defence, & are firmly tied to their head and bottome, but disioyned in the middle. These *parastatae* do arise from the spirie boddin body [tab. 1. 6. tab. 2. 8] by continuation, & creepe obliquely backward & downward to the *basis* or bottom of the testicle, & from thence are reflected or turned back againe vpward [tab. 1. fig. 2. 7. as] but without connexion or copulation, and being rowled as it were into a round orbe, carry the forme of the tendrill of a vine crumpled vp together: wherefore *Galen* out of *Microphylus*, calleth them *νεφροειδῆς παρὰ δῆς* in his 14. Booke de *usu partium*, and the 11. and 13. chapters. For they are white, long, thicke, and rounde, distinguished with certaine furlles or conuolutions like a wood-worme, and by degrees become narrower, determining on both sides into *Vas deferens* or Leading vessell which is like a round

Table 2. sheweth the lower Belly with the Share bones parted, that the vessels which serue for generation might the more plainly appeare.

TABVLA II.



aa A part of the midriff and of the *Peritonaeum* with the ribs broken.

bb cc The Convex or gibbous part of the Liver marked with bb. the hollow or concave part with cc.

de The right and left ligaments of the Liver.

f The trunk of the gate veine.

g The trunk of the hollow veine.

h i The fatty veines both left and right.

i The ascent of the great artery about the hollow veine, and the division thereof.

k The Celiacall artery.

m n The emulgent vessels.

oopp The fat tunics or coats torne from both the kidneys.

qq The vreters that goe vnto the bladder.

ru The right spermaticall veine which ariseth neare

xy The double original of the left spermaticall veine x from the emulgent, y from the hollow veine.

a The originall of the spermaticall arteries.

β Certaine branches from the spermaticke arteries which run vnto the *Peritonaeum*.

γ The passage of the spermaticall vessels through the productions of the *Peritonaeum*, which must bee obserued by such as vse to cut for the Rupture.

δ The spirie bodden bodies entrance into the testicle, it is called *Corpus varicosum pyramidale*.

ε The *Parastatae*.

ζ The stone or testicle couered with his inmost

coat. η The descent of the leading vessel called *Vas deferens*. θ The Bladder. * The right gut. § The glandules called *Prostata* into which the leading vessels are inserted. ρ The muscle of the bladder. στ Two bodies of the yard, s and τ and υ his vessels. φχ. The coat of the Testicle. ↓ The muscle of the Testicle ↓. his vessels ω.

round sinnew. Some there be as *Vesalius* and *Platerus*, who would rather haue them to be the beginning of these *vasa deferentia* or Leading vessels. And because their substance is a little more solid then that of the Testicles, they are esteemed to be of a middle nature betweene the vessels and the testicles, that is harder then the later, and softer then the former.

These *Parastatae* are also on their outside membranous and neruous, and where they are without conuolutions smooth they are and euen, but within glandulous, and if they bee cut they appeare spongy or spongy as if they consisted of many small glandules. But when they are separated and remoued from the coats of the testicle, as they may easily bee with a sharpe knife, then are they vnequall. They haue no pores or passages to bee seen in them; yet there bee that thinke (*Vesalius* among the rest) that they haue small pipes continuated with the Testicles, through which the spermaticke power arriueth vnto them out of the Testicles.

Their vse is either to hinder the seede not yet sufficiently laboured from falling downe out of the preparing into the leading vessels, or to labour the prepared seede to a further degree of perfection by the helpe of an irradiation they haue from the testicles. For they are often found full of seede, so that they may bee called not amisse, little stones or testicles. Again, they serue to temper and moderate the ouer frequent motion of inordinate concupiscence, as *Aristotle* conceiueth in his first Book *de generatione Animal. Chap. 4.*

neth no oily substance that might congeale into fat, because all the ouerplus when the testicles are nourished is changed into seede.

The second Common coate (called *Septes*, because it may easily bee separated from the rest) is produced from the fleshy membrane [Table 17. lib. 3. c.] where it is much thinner then in others parts, and replenished with Veines and Arteries: with both those coates are the Testicles inuelted and suspended, that they might not be iniured either with heate or cold, and so become vnfruitfull and barren. Also when they yarde is flaccid or loose they hang

The second
Common coate

The second Figure sheweth the seminary vessels, with the Testicles.

The third Figure sheweth the diuers formes of the Testicles, and their senerall parts.

TABVLA III.



mm The Vreters.

oo The spermatike veines and Arteries.

u The coate of the testicle which ariseth from the Peritonaeum.

x The spermatike veine and artery as they passe into the production of the Peritonaeum, and as they passe againe out of it.

u The bodden body called *Corpus varicosum* or the wonderfull implication of the veine and artery.

v The left Testicle covered with the inmost coate.

xi The reuolution of the leading vessells.

o The ascent of the leading vessel vnto the share bone.

o The reflection or returning of the leading vessells, to the backe side of the share bones.

o The coition or meeting together, and inserti-

on of those vessells into the Glandules called *Prostate*, at o.

Figure III.

AB. The forepart of the right Testicle. CC, D. The spermatike Veine and Artery cut off where they fall out of the *Peritonaeum*, and C, sheweth the beginning of the bodden body, called *Corpus varicosum*, and D, sheweth the *basis* or foundation. E. The passage of the leading vessell. F. His reflection. G. A portion of the leading vessell climbing vpward, with his departure from the Testicle. H. The porous or spongy face of the leading vessell of *Epididymis*, where it groweth to the coate of the Testicle. I. The gibbous or round part of the same vessell, where it groweth not vnto the foresaide coate. L. The fore-part of the Testicle. M. The backe-part of the same together with his inmost coate, and the bodden body. NN. The first commixtion of the spermatike vessells. OO. The *basis* of the spiry bodden body, and his insertion into the inmost coat of the Testicle. P. The Testicle covered with his inmost coate, shewing the vpper part into which the bodden or varicous body was inserted. Q R S. The inmost coate of the Testicle, drawne from the Testicle at R. but couering the Testicle at S. T. the Testicle cut through the middest. VV. The distribution of the vesselles through his substance.

downe, but when that rises or is distended, then the skin being also contracted and corrugated and with the yarde drawne vp, the Testicles also are suspended and drawne vpward; which ordinarily is obserued as a token of strength in young Children, who are often suddenly diseased; but if their Testicles be thus gathered vpward, it is commonly & not without reason, hoped that their naturall strength remaineth vndecayed; whatsoeuer the present cause or violence of the disease may be.

Why the corrugation of the Cod is a signe of strength.

The proper coates which doe inuelt each of the Testicles by it selfe are two, yet *Columbus* maketh three proper, and reprehends *Vesalius* for making but two. The first and vtter is called *inuentio*, that is, *vaginalis*, as it were the sheath or huskie membrane [Table 17. lib. 3. c.] where it appeareth whole; tab. 3. Fig. 2. II. tab. 2. at o x cut open] for so saith *Pliny*, Prouident Nature hath inclosed all the principall bowels, *membranis proprijs ac veluti vaginis*, that is, In proper membranes, as it were corne in the huskes. It is also called by *Paulus* from the

Their proper coates. The first and vtter.

Paulus

fashion

fashion it carrieth *ἐλκροειδής*, or *Capreolaris*, that is the Tendrill. It ariseth from the production of the *Peritoneum*; it is thinne and strong, and outwardly groweth to the *σάρτιον*, fastened with a multitude of membranous fibres [table 17. lib. 3. from *n* to *t*,] which *Columbus* thought to be a particular coate, yea & some fibres there are which ioine the husky coates of both the Testicles together. Inwardly it is also thinne but lined with a watery humour and aboundeth with veines. To this coate sometimes are added certaine small fleshy fibres (whence it is called by *Oribasius* the great Abreuiator of Antiquity *ἐρυθροειδής*, from *ἐρυθρίαι*, which signifieth to grow red; for such is the coate where these fleshy fibres are) which goe vnto the bottome of the Testicle.

The vse of the vter coate. The Vse of this Membrane is thought to be, that whilst it inuolueth the stones as it were within a huske or sheath, the spermatike vessels are closely knit vnto them; or that there might be an infusion of imperfect seede into the Testicles out of the vessels, or rather, that from the Testicles some force or faculty might reach vnto the vessels.

The second & inner coate of the testicles. The second or inner proper coate of the Testicles (called by *Vesalius* and *Archangelus* *ἐπίδιδυμς*, because it immediately encompasseth the Testicle, in Latin *Albuginea*, the white coate [Table 2, 3. table 3, figure 2. n. figure 3. QRS] which ariseth from the coate of the spermatike vessels) is white, thicke, and very strong; whence *Raffus Ephesus* calleth it *σκληρὸν καὶ πρὸς οὐσιν*. It immediately inuolueth the substance of the Testicle, that it may firme, stay, and as it were knit together his soft and laxe flesh [table 3. figure 3. r.] least otherwise it should haue beene too loose, and so haue proued vnprofitable; as also that by his interposition as it were of a meane or middle nature, the harder vessels might more fitly grow and apply to the softer substance of the testicle.

Their Figure. The Testicles are round of an ouall figure saith *Laurentius*, or like eggs depressed or flattened somewhat on either side; and they hang obliquely or sidelong because of the vessels which grow vnto them, and because of the protuberation or bunching out of the *Parastata*, as if they were two small stones; which protuberation in lasciuious men is not vnusuall. The vpper bunching part is called by *Aristotle* & *Galen* *κεφαλὴ* the head, the lower which is blunter and larger is called the bottome; by *Pollux* *πυθμὴ*. The right is the hotter because of his vessels which transfer from the hollow veine and the great arterie more pure and sprightfull blood vnto it: it is thought also to be more bodden or embossed, and the seede on that side is thought to be better concocted, albeit *Vesalius* denyeth any difference, who doeth not conceiue that the procreation of Males and Females dependeth vpon the greater or lesser implication of these substances. Yet *Hippocrates* calleth the right *ἀρρενόγονος*, that is, the Male Testicle, and the left *θηλυόγονος*, the female Testicle which is fuller of seede then the other, but that more weake and waterish, hauing most of his matter from the emulgent; whence it is that the Nature of women seemeth to be more intent vpon generation then that of man, euen from the very beginning: witnesse the childish disports of young Girles in making of Babies, Nursing, and lying in, as we say, and such like pastimes, wherein they are occupied euen from their infancy.

These Testicles being ioined by the interuening of membranes, do hang downe from the sharebones and the yarde.

Their substance. The substance of the Testicles is glandulous, white, milky, soft, laxe or loose in men and spongius, because of many small veines [table 3. fig. 3. u u] dispersed through their bodies, but yet there appeareth no cavity or hollownes in them.

Muscles. They haue on each side one muscle and that a long one [table 2. v. table 3. figure 2. x] and slender, beginning at the hanch bone, or rather from a strong ligament which runneth from the hanch to the share-bone in that place where the transuerse muscles of the lower belly doe end, of which these muscles seeme to be a part, and they get out by the out-let of the Tendons of the oblique muscles, and outward neere the leskes they grow to the vessels which attaine vnto the Testicles and vnto the heades of the Testicles themselues. Sometimes from the forepart of the share-bone there are certaine fleshy fibres communicated vnto them, so that they may be obserued to haue (as they haue alwayes in Apes) a double originall.

By the benefite of these muscles, the Testicles which are pendant, are suspended or hung (whence they are called *κρεμαστές*,) that they should not bee a burthen to the spermatike or seed vessels as we touched before. Moreouer in copulation or coition they draw them back, that the seed-trough becoming shorter, the seed may more easily and readily be supplied. And *Galen* in his fourth booke *de usu partium* and the 14. Chapter sayeth that they

Their vse.

Cremasteres.

The connexion and originall of these muscles.

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Galen.
Pollux.
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For their nourishment and life the Testicles receive matter from the spermatike [table 2.] veines and arteries. How then may some say are they nourished with blood? I answer, as the Paps are nourished with Milke; for their blood is not red but turned into Milke and Seed; as also the bones are nourished with marrow. For all the parts of the body are nourished with blood, either red or turned into a substance more convenient for the part which it is to nourish. A reasonable nerve also they have, from the rib branch [table 6. lib. 2. fig. 1. iii.] of the sixth paire, sometimes also two other nerves arrive unto them from the 21. coniugation of the marrow of the loynes (that hanging out of the body they might not yet be deprived of exquisite sense) which after being ioyned to the spermatike vessels are carried downward, and implanted into the coats of the Testicles.

Their vessels by which they live.

The use of the Testicles is (for that without them neither can seed be ingendered nor any absolute Creature perfectly generated) by their inbred faculty to give to seed not so much the colour (for it falleth not into the substance of the Testicles as Vesalius and Laurentius do suppose it doth) as the very forme and generating power, and that so strong and vigorous, that a perfect and absolute Creature out of it may be generated; which power in men is the cause of virilitie, and in a woman of womanhood or muliebritie. Moreover by reason of this faculty the Testicles are esteemed the prime instruments of generation, and also by some, Principall parts of the body.

The use of the testicles.

They adde also to the body much strength and heate as appeareth by Eunuches, whose temperament, substance, habit and dispositions are all altered, as we shall heare hereafter, and that because of the great consent of the vpper parts with these Testicles mentioned by Hippocrates in his second Booke Epidem. and the first section, in these words, *when the Testicles doe swell upon a Cough, it putteth vs in mind of a sympathy and consent there is between the Chest, the Paps, the Seede, and the voice.* And how great the consent is betwixt the parts of respiration and the parts of generation, he sheweth in the fourth Book Epidem. and the last Aphorisme saue one, on this manner. *They are troubled with a dry Cough whose Testicles doe swell, and that Cough endeth in the tumor of the Testicle if a veine be opened; and when the Testicles are inflamed men do Cough much.* And againe, *Those that are agueish with tumors in their leske, haue Coughs follow them continually.*

Their consent with other parts.

Of their consent with the chest.

For the consent of the Testicles with the head, I can give you a notable instance of a wanton young fellow, who vpon a small and almost insensible tumor (especially at some times) in or about one of his Testicles, fell first into light, and after into extreame fittes of the Epilepsie or Falling sicknesse, whose name I suppress, not for his desert toward them that deserved well of him, but for the reuerence of our Art.

The head. A story worthy the observation.

Finally, in excellency the Testicles are like unto the heart: for that Cordiall Epithymatics applied to the Testicles in great languishments of the spirits doe little lesse auaille, then if they were applied to the heart it selfe.

The heart.

CHAP. V.

Of the vessels called Vasa deferentia, or Leading vessels.

 THE Vessels which Leade the seede called vasa deferentia [Table 3. Figure 3. H I, separated from the Testicles] are called by Herophilus ὁδὸς σπέρματος, by Fallopius, Canalis seminaris, the seede-cane.

They are situate partly without the Abdomen in the scrotum or Cod, partly within the cavity or den of the Hip-bones on either side one, at the head of the testicle, and are produced from the Parastata, to which they are continued, [tab. 1. fig. 1. p. 2. b.] as also are the preparing vessels, [tab. 1. figure 1. f.] although their names be diuers according to their distinct offices and situations.

Their situation.

Their substance is nervous and crumpled or writhen, [tab. 2. a, the descent of the Leading vessels, from i to r the reflection or turning of it; and [table 1. fig. 2. y, is the originall of this vessel, his descent at a, his revolution at b. [tab. 3. Fig. 3. from E to F downward] contorted at the lower end of the testicle; but where they are parted from the Testicles, they are round and white, and their cavity or hollownesse is but obscure [tab. 3. fig. 3 H sheweth the porous surface of the leading vessel, where it groweth to the couering of the Testicle]

Their substance.

Connexion.

neyther needed it to bee more open, because the seede by reason of his abundance of spirites wherewith it riseth and houeth or worketh vppe, can easilie passe thorough.

Progresso.

They arise vppward [table 3. fig. 3, G] and are tyed to the preparing vessels [Table 2. at 2] by the mediation of a thinne and small Membrane, presently after (by the same way by which the preparers descended) they are carried through the productions of the *Peritonæum* [table 2. at 9, table 3. figure 2. 0. 5] to the share-bone, at which place the bone hath a superficialie cavity [table 2. 6, lib. 3. figure 12, 13, 7] which giueth way vnto the roundnesse of the vessels.

Vniting.

After being returned downward [table 1. figure 1. from 7 to 5, tab. 3. fig. 2. 7. 5] like Nerues, and tyed on the backe side (where the humour they containe is now become white) to the *Peritonæum*, they are led ouer the [table 3. figure 2, 11] Vreters, and vnder the backe side of the bladder about the right gut neere vnto the necke of the Bladder; a little before they vniting together [table 1. figure 2. 8. and table 3. figure 2, 7, is the vniting of Leading vessels] they are on eyther side dilated and become thicker, where these small Bladderets of seede [table 2. fig. 1, 22] called *Vesiculae Seminae*, are adioyned vnto theyr sides, but the Leading Vessels themselues are spent, the right into the right, the left into the lefte *Prostate Glandule*. [Table 1. fig. 2. 11. table 3. figure 2, 9]

Their vse.

The vse of these Leading vessels, is to carrie or leade the seede after it is laboured in the *Parastatae*, and made fruitfull and prolificall by the Testicles, vnto those *Prostate Glandules*, as it were vnto certaine Magazines or Store-houses, where the right Vesselle meeteth and coupleth with the lefte, that the seede of each Testicle might together and at once bee thither conueyed, and so shot together into the Wombe by the Virile Member.

Moreover, their oblique passage furthereth much the seedes perfection; for as in making of *Aqua vita* or such like strong spirits of wine, wee see the liquor first ascendeth and then descendeth, so the seede being to become a frothy body, did of necessity require such sublimation and precipitation to make it absolute and perfect.

CHAP. VI.

Of the Bladders of seede.

What the bladders of seede are.



He small bladders of seede [table 1. fig. 1. 22, shew them open] are placed betweene the Ligaments of the Bladder of vrine and the right gut at the sides of the leading vessels a little before they become thicke and are vnited. They are compounded (saith the Author of the Definitions) of a veine and an Artery mixed together. They are on either side one, neruous, large and sayre enough to be seene, hauing not as other bladders one cavity, but are full of boughtes and turnings like burst or knotted

Why created

veines, implicated or folded one within another (and therefore *Herophilus* calleth them *παράστατες νεφροειδείς, Adstites varicosos*) so that they seeme to be many, and in them (saith *Fallopins*) seede may be kept many months. For Nature being desirous of the continuance and perpetuie of mankind, ordained, that all times should be fit for their procreation, and therefore it was verie meete, that a matter rightly for that purpose disposed, should at all times be readily supplied, but because man coulde not alwayes entend that worke, and yet it was necessarie, that euen this excrement or surplusage should be auoyded, therefore like other excrements it also was to bee gathered together in some place and there kept till a fit occasion were offered, that from thence it might bee shot forth.

Varolius.

And for this purpose (sayth *Varolius*) these Bladderets were created, into which the seed should bee continually emptied out of the Testicles, and therein stored vp against the time of expence.

Their vse.

But least so great a quantity remaining in one place should corrupt, there are many turnings and windy boughts and passages in them, which also are a stay vnto the Seed, that in one Coition or accompanying of the sexes, al the seede should not bee spent. For, the seede winding it selfe out of those manifold Labyrinths by degrees, doth passe away more safelie and moderately, and with better stay and deliberation.

Banhsine.

But we (saith *Banhsine*) haue hitherto obserued that these bladderets are full of a yellow oily humor wherewith the passage common to the seede and the vrine is illined or smeared least it should be hurt by the acrimony of either of them, or least when it is drie it should

close

close together, and so hinder the next euacuation. For to this end in copulation this oyli-
ness together with the seede yssueth sensibly and feelingly, at other times it wellet out
insensibly; *Galen* addeth in the 14. Booke de *usu partium* cap. 11. that it prouoketh lust, and
keepeth moyst the necke of the bladder of vrine.

CHAP. VII.

Of the Prostata.



The Prostata as it were fore-standers, are called by *Herophilus* *σποδάριος* and *σποδάριος*. *Columbus* calls them *Parastata*. *Fallopian* calleth them *assistant Glandules*.
Varolius two Testicles smaller then the other. *Vesalius* out of *Galen* calleth
them *σποδάριος*, that is, Glandulous bodies. And so indeede they are
two Glandules [table 1. fig. 2. m.] on either side one, placed in the cauitie of
the Abdomen at the lower part of the bladder [tab. 2. e] that is, in the necke about the sphin-
cter [tab. 2. p. tab. 1. fig. 2. d] Muscles, or rather betwixt the necke of the bladder, and the lo-
wer Muscles of the yard at his roote, where the Leading vessels are vnited. [tab. 1. fig. 2. d]

These Glandules are depressed before and behinde, but round on the sides, into which
as it were into other testicles, the leading vessels do end.

They are couered with the Membrane which did inuest the leading vessels, but now be-
come somewhat thighter, least the substance of these Prostata being rare and spongie, the
seed should soake out of it owne accord through their open pores, albeit they be very nar-
row. Yet is this Membrane verie thin, and hath in it verie blinde breathing pores, which at
the first sight are not conspicuous, but when the Glandules are pressed, they appeare, for
by them the seede may be scrused in notable quantitie into the common passage, as it were
by grains or like smal seeds, euen as we see Quick-silver passeth through leather wherein it is
fast tied, if it be strained, whence also in coition great pleasure ensueth; the exquisit sense of
the membrane being tickled in the passage with the gentle and pleasing acrimony of the
seed.

Their substance is hard, spongie, and whiter then the rest of the Glandules, they are also
large, as containing in them so much seede (saith *Archangelus*) as will serue for the procre-
ation of foure or five infants; three or foure (saith *Columbus*) in those that are fruitful. And
therefore it is no wonder (though *Aristotle* writeth it for a wonder) that a Bul after his testi-
cles are cut off, may get a Calf. *Vesalius* hath obserued that the prostate glandules are noto-
riously large and full in Monkeys; and indeed they are of all creatures the most lasciuious,
as we do not only reade in authors, but haue also seene by the great Baboons which were
heere to be seene among vs; for they would in a manner offer violence euen to a woman. It
is therefore a very wicked and inhumane thing for Gentlewomen to cherish any kinde of
them in their bosoms yea in their beds, as I haue seene some doe with mine owne eyes.

The vse of these prostate lay some, is to add somewhat to the generation of seed, and their
reason is, because there is no where found so great quantity of it as in them: but if this were
true then euen gelded creatures would engender seed, and seeke to auoid it, which *Galen*
worthily gainsaith. *Varolius* seemeth to countenance this conceit, who saith, that in the
end of the leading vessels there are placed two other small testicles, which giue vnto the
seed his vttermost absolution or perfection, the leading vessels ministering vnto them, as the
preparing do to the Testicles.

Their true vse is to receiue from the leading vessels the seed now sufficiently laboured &
made prolifical or fruitfull, and to keepe it till the time of profusion or spending as we say. It
may be also they make it more thick as adding the last hand vnto it, for it appeareth in these
thick and white, in the testicles but thin and serous: sure it is, that the seed neuer procureth
pleasure till it come from them, witness those that are immoderate wantons, who spende
themselves so frequently that there is no time for the seede to bee stored vp in these parts;
their minds indeed are more then brutishly lustfull, but their bodies are not so delighted as
other more moderate men by their owne confession.

These Glandules being pressed on their backe sides by the lower Muscles of the Yarde,
[Tab. 4. fig. 1, and 2. H I] which arise from the sphincter of the fundament, [Tab. 4. fig. 1, M]
do constrain the seede into the common passage [Tab. 4. fig. 2. G] which in the fore-part of

Galen

Their names

Situation

Figure

Membrane

Comparison

The true
cause of plea-
sureTheir sub-
stance.
Archam.
A Bull may
get a Calf
when hee is
castrated.
A beastlie
abuse.

A false vse

Galen

Their true vse

How these
glandules are
pressed

it they open. Into which their insertion can hardly bee discerned, but is opened when the seede flowes forth.

A story out of
Vesalius.

Vesalius telleth a tale of a fellow that was hanged at Padua in Italy who had the running of the reines, in whose body euen after his death all these passages were manifestly open and free, especially those of the leading vessels into the neck of the bladder. Moreouer with their solid and firme substance they support the neck of the bladder, that it should not faile or fall, that so those narrow passages, and for the most part insensible which attain vnto the end of the necke of the bladder, should bee kept streight, that the eiaculation of the seede might not be interrupted in the excretion, although the fall of this doe stay the yssue of the Vrine.

CHAP. VIII.

Of the yard or virile member.

The names.



THE Yard is called in Latine *penis à pendendo* of hanging, and *Virga*; in Greeke *κavλός*, and by an excellency *μόριον*, that is, *virile membrum*, the virile member, because of the fecundity thereof. Many other names it hath both in Greek and Latine, a Catalogue whereof *Laurentius* hath putdowne vnnecessary for our turne, wherefore we haue spared our owne labour and your eares. The scituation is well knowne to be at the bottome of the lower venter on the outside [tab. 4. fig. 1, 2] as neere the fundament as it wel might, and not be troublesome by falling vpon it in the time of seidge: Not about the groine, or in the *Hypogastrium* or watercourse, because there is no bone to establish his originall. It was therefore necessarie it should arise at the very roots of the share-bones, as well for the establishment thereof in the act of generation, as also that it might be more fit to meete with the womans lap, and yet no hinderance to the actions of other parts. And because it was not necessary there should be more of them then one, it is placed alone in the midst. Long it is, [tab. 4. fig. 1, 2] round but not exactly, for the vpper side of it, which they call the back, is somewhat broader, and endeth in a dudgeon or blunt point. The length and thickest of it is diuerse, as well in respect of the kindes or species, as of the particular creature or *indivium*. In respect of the kinde, it is of such a length and magnitude as the necessity of the kind requireth for procreation: but in men shorter then in many other creatures, because men doe vse *aduersam non auersam venerem*. Of the *indivium* or particular, because it is formed comonly according to the proportion of the members, yet sometimes it is large in a little man, because of the abundance of the portion of the fathers seede of which it is framed, for the seede falleth from euery part of a mans bodye, and carrieth in it power of generating that part from whence it fell. Although *Galen* in his sixth Booke *de locis affectis* towards the end, writeth, that continence makes it to encrease, at least in thicknes. It is thought also it will be longer if the Nauill strings [tab. 4. fig. 7. VV X] bee not close knit by the Midwife when the childe is new borne; and that because of a Ligament which commeth to the Nauill from the bottome [table 4. fig. 7, X] of the bladder which they call *Krakhos*, for the straighter that is tyed vnto the Nauell, the more the bladder and the parts adioyning are drawne vpward.

The reason of
the scituation.

The Figure.

The dimens-
ion.

The cause of
the largenes
of the yard.
Galen.

How to make
it long.

The coates.

The parts of it

That part of the yard which hangeth out of the *Abdomen*, is couered with a cuticle and a skin not very thicke (which is laxe or loose when it hangs, but in erection is stretched) equall to his length, and knit vnto it at the lower part of the *glans* or nut, it is also couered with a fleshy membrane which heere becommeth neruous. There is no fat betweene the coates, least the member should grow by that meanes too great, and so his action be hindered, or too soft which would hinder erection.

It hath two parts, the one next to the belly which is the more principall, and hangeth not out, and it is called *σπέρμα*, which is below the commissure or ioyning of the share bones, to the middest of which it is fast knit in the *Perinaum*, (that is, the space betweene the cods and the fundament) with strong Ligaments and Muscles, and arising vpward vnder the testicles, appeareth round about the *scrotum* or cod.

The other part of the yard is called *σπέρμα*, and hangeth downe without the body from the vpper part of the share-bone if it be flaccid, or if it grow strong & rigid, it is raised vpward and so stands commonly so farre from the body, as the necke of the wombe is in length in-ward

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ward, that so it may yeeld seede vnto the very orifice of the wombe for the propagation of mankinde.

The structure of this member is such as is fittest for his vse and the necessity of Nature. The structure.
Why not a
bone. It is not bony, as in a Dogge, a Wolfe and a Fox; for so it would not be a pleasure but a great trouble to the other sexe, besides, being alwayes rigid or stiffe it would haue beene both vncomely and haue hindered many actions and postures or positions of the body.

It is not gristly or *Cartilaginous*, for then it could neither haue beene distended (for a Gristle. Cartilage hath no cauitie) neither could it haue beene soft and pliable.

It is not of the Nature of a veine, for then it could not so soone haue beene filled and Veine. emptyed againe; as also for that the simple coate of a veine would not haue endured any strong streatching.

It is not of the nature of an Arterie although that haue a thicke and hard coate, because Artery. of the continuall pulsation, vpon which a man cannot lay a law when he pleaseth.

It is not neruous, because Nerues haue no manifest cauitie, neither are they naturally Nerue. dilated; beside that, the softnes would haue hindered the tension or erection.

It is not a Ligament, although that would haue been fit for tension or erection, because Ligament. then it should haue had no cauity; and being beside without fence, it would not haue beene capable of pleasure.

It is not a Tendon, because they haue no cauity, and are beside softer then Ligaments, Tendon. and so not so fit for erection.

Much lesse could it well be made of flesh, or glandules, or muscles, or membranes.

It was therefore requisite that some other peculiar substance should be found out, such as was not else where in the whole bodie, that should be hard & hollow, that without difficultie or inconuenience, might successiue at conuenient times according to the presence or absence of the spirits bee rayed vp, or againe sinke or settle downe; and of so exquisite fence beside to breede that pleasure, whereby man is prouoked to rush into so obscene a peece of businesse.

Of such sort and structure therefore there are two bodies [table 1, figure 2. ii, table 4. How the yard
is construed. figure 1, 2, 3, 4, 5, 7, 9. *AB*] which together with the Cannell or passage doe make the yarde. They are hard, neruous and like ligaments, on either side one, arising from the lower part of the share-bone [table 4, figure 2, 3. *CC*] where it is thicke and round, and the vpper part of the *Coxendix* or hanch, as well that hauing a substance partaking somewhat of a bone, the yarde might bee better disposed to rigiditie, as also hauing his originall for a stable body, it might bee kept stable and straight in the performance of his action to which it is by nature designed.

These bodies are on the outside round, on the inside plaine, and below at their originall The 2. bodies. are diuided [table 4, figure 4. and 5. *EE* the two bodies, and *G* the canale or pipe] that they may yeeld way vnto the passage which commeth from the Bladder; by and by they are carried vpward, and about the middle of the share-bone they are ioyned together [table 4, fig. 4, 5. *F*] yet so as they seeme to bee distinguished by a white Line running in the midst of them if the yarde bee cut ouerthwart. [table 4, figure 4.] From thence they are returned downward to the Nut [table 4, figure 4, 7, 9. *D*] and doe inwardly end in an acute angle, and together with the canale or pipe doe fashion out the length of the yarde.ouer those ends groweth the substance of the glans or nut, and so the whole figure doth in some sort represent the greeke ζ , which therefore ought to be obserued because of the vse of the Catheter The Catheter. in the suppression of the vrine. For if the Catheter be not insinuated or gently put in with a kinde of dexterity, it either hurteth the pipe or the necke of the bladder so that bloud will follow, or else it will not passe into the cauity of the bladder.

The substance of these bodies is excauated or hollowed like a pipe (from whence they are called the hollow nerues) but of a fungous or spongy matter [tab. 4. figure 4. 5. *EE*] and filled with blacke bloud: so that naturally it is blackish. A remarkeable obseruation for A good note
for Chirurgi-
ons. Chyrurgians, that in the section of a putride yarde, they doe not take that for rotten which indeede is but Naturall; the want of which knowledge I am perswaded hath cost many a man a good ioynt, which otherwise might well haue beene saued. It is also wouen like a Net made of innumerable branches [Table 1. figure 1. ii, table 4. figure 5. *b*] of veines and The vessels of
the yarde. arteries diuersly intangled together which are very notable vessels, and arise here from the region of the great or holy-bone [tab. 8, Lib. 3. *tt.*]

These bodies are also rare and porous, that they might suddenly bee filled with spirites and

The vse of
the structure
of his bodies.

and with venall and arteriall bloud when the yeoman is irritated or incensed; and his violence being appeased, the same spirits and blood being partly dissipated & partly returned into the vessels, settle and shorten again. For if the member were alwayes strong and stiffe, it would be a great hinderance to men in many labours of this life, especially such as are violent, and beside it selfe would bee alwayes subiect to mischietes, euen as the arme or hand would be if it were continually streatched forth. On the other side, if it were alwayes flaccid or loose, it would be vnprofitable for that imploiment for which God and Nature haue ordained it. Wherefore onely in the time of coition it ought to bee swolne and rigged or erected; swolne and extended to a iust magnitude that it might fill the necke of the matrix, *ita ut utriusq. pudenda incalescant*. For it is mutuall heate which calleth and prouoketh the seed out of the inner parts; Rigid and straight not onely *ad commodiorem coitum*, but also that the passage being open and direct, the seede might more freely and directly bee eiacted or shot forth from the very *Prostata* wherein it is contained. For if it were either oblique or crooked, (as it is in those which are called *υποσπασιας* in whome the passage is retorted by reason of a bridle at the end of the yarde, who therefore cannot procreate vnlesse that bridle be cut) or did in any place not stand open but fall together, then would the seed stay or make stop in the passage.

The coates of
the yarde.

But againe, least the spirits which flow vnto it, and by which it is distended, should bee too soone dissipated or scattered through the fungous or spongy substance, it is couered and strengthened with membranous coates thight and very strong (which some men imagine doe arise from the commixtion of those vessels which passe vnto the yarde,) which are therefore called the neruous bodies of the yarde, and they are also thicke and substanti- all, that they might more easily be distended.

Comparison.]

For when as in venerious appetites, the bloud and the spirits do in great quantity assem- ble themselves out of the veines and arteries, that member is as it were a gutte filled with winde, presently swelling and growing hard; which no question commeth to passe when as the sphincter muscle (which encompasseth the necke of the bladder, the roots of the bod- ies of which the yarde is made, and the ends of the guttes) is contracted and presseth out the spirits abounding in those parts, vnto the yarde; for so wee see the iugular or veines of the throate to be distended, when in laughter the chest is compressed and straightned. So also the veines of the arme by reason of the constriction of a Ligature or tye are distended and growe hard and full: so then it appeareth that voluntary motion is not onely requisite for erection, but also for induration.

The pipe of
the yarde.
Galen.

The Pipe or Canale of the yarde [*tabl 4. figure 1, 4, 5, 7. G*] which in greeke they call *επι- σπασ*, the vrial pipe, or as *Galen* in his 15. Booke of the vse of parts and the 3. Chapter, the *spermatike pore*, commeth from the bladder [*table 1, figure 1. A* from the bladder *e table 4. figure 6.*] whose necke is long. This Pipe scituated vnder the bodies of the yarde [*Table 4. figure 4. and 5. G* vnder *EE*] is reflected together with them (in which reflection or retur- ning if putride or rotten seede in a *Gonorrhoea* or Running of the reynes, doe subsist or make stay, it there vlceraeth the passage) and becomming in the middle betweene them, it pas- seth along the length of the yarde vnto the outside of the Nutte; where it is embraced by those bodies ioyning together [*table 4. figure 4. 5. F*] in narrow angles, and so maketh the whole yarde perforated as was necessary for the emission of seede.

How the seed
putrifieth in a
Gonorrhoea.

The membra-
nes of the pipe.

This Canale or Pipe hath two membranes (of which none almost of the Anatomistes make any mention, saue *Bauhine* onely, and *Archangelus* of the inner) one inward and thinne wherewith also the nut or glans is couered, bred out of the thin meninx or *pia mater* of the braine, which inuesteth the nerues of the yarde, in which certaine circles are to be seene; & beside there is in it an exquisite fence to make it capable of the pleasure which the seed in his passage through it stirreth vp, and againe it circumscribeth or limiteth the circumfe- rence of the Canale or pipe.

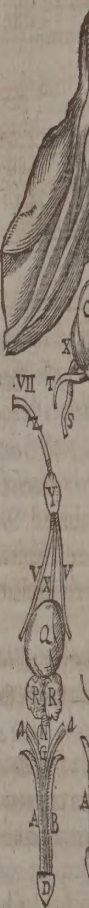
The other Membrane is outward and fleshy, compounded of transuerse fibres for the better expulsion of the seed and vrine.

The middle substance of this pipe is lax [*table 4. fig. 6*] fungous or spongy and blackish so that it readily distendeth it selfe together with the neruous bodies in the effusion of seed, and againe as readily falleth in the euacuation of vrine.

A common
passage.

This passage is common to the Seede, the oylie humor issuing from the small bladders before spoken of and the vrine; and in the forepart of the Nut it hath a yawning out-let, by which these substances are auoyded. It is narrow in young folk, in others so much broader

Tab. 4. demon-
strating the
structure of the
first and se-
cond of the
third mem-
ber. The 4. and 5.
The 6. the canal
the bladder.
The 7. the fore-
part of the
umbilical ve-
nue. The 8. the bladder
a part of the
The 9. the mouth of



der as the skin is
of a student in the
for seede, but that
was not necessary
ture contented be-
the necke of the b-
the yard.

But because the
should also have
precisely in his Bo-
that worthy labour
remaine. In the fit-
which faith *Refali-*
ding to *Bauhine*. The
pendix of the hips
second they hang

Tab. 4. demonstrateth the muscles of the yard, of the fundament and of the bladder, and the three bodies of the yard.

The first and second figures shew the yard excoriated, cleaning yet to the bottome of the share bone.

The third sheweth the same separated with his vessels.

The 4. and 5. the yard cut away, and Dissected ouertbwart.

The 6. the canel or pipe of the yard, divided at the entrance into the bladder.

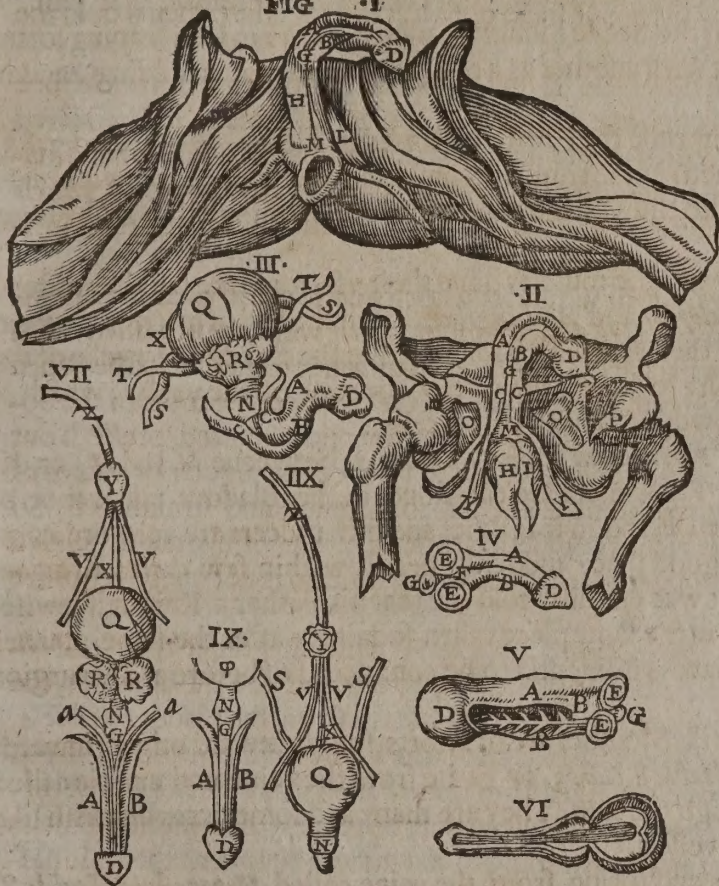
The 7. the forepart of the bladder and the yard, together with the umbilical vessels.

The 8. the bladder of a woman, with the umbilicall vessels, and a part of the Vreters.

The 9. sheweth the backe parts of the body of the yard.

TABVLA III.

FIG. I.



A B, 1, 2, 3, 4, 5, 7, 9. The two bodies which make the yard.

CC 2, 3. The place where these two bodies do first arise.

D 1, 2, 3, 4, 5, 7, 9. The nut of the yard called *glans penis*.

EE 4, 5. The fungous and redde substance of the bodies of the yard.

F 4, 5. The mutuall connexion of the bodies of the yard, and the neruous outward substance of the same, compassing rounde about the former fungous substance.

G 1, 2, 3, 4, 5, 7, 9. The passage of the vrine, or common pipe running vnder the yarde all along his length.

H. I. 1, 2. The first paire of Muscles of the yarde which in the first figure do yet grow to it, but in the second they hang from their originall.

K. L. 1, 2. The second paire of Muscles of the yarde, in the first figure growing, in the second hanging from their insertion.

M 1, 2. The sphincter of the right gut.

N 3, 7, 8, 9. The round sphincter Muscle of the bladder.

OO A Membrane which is ouer the holes of the share bone.

P 2. A rounde Ligament from the meeting of the share bones vnto the head of the thigh.

Q 3, 7, 8. The body of the bladder.

RR, 3, 7. The Prostate, into which seede when it is perfectly laboured, is led.

SS, 3, 8. Portions of the vreters.

TT * 3. Portions of the vesselles which leade downe the seede.

V V, 7, 8, the umbilicall arteries.

X 7, 8. The ligament of the bladder cald *Urachus*.

Y, 7, 8. The navel or *umbilicus*.

Z, 7, 8. The umbilicall veine.

aa 7. The veine and artery of the yard.

bb 5. The artery distributed through the bodye of the yard.

der as the skin is more or lesse retracted or drawne backe from it. *Vesalius* maketh mention of a student in the Law at *Forum Iulij*, who had two distinct passages, one for vrine another for seede, but that is indeede very rare. For, because the bladder was scituated so neere, it was not necessary that another passage should bee made for the auoyding of vrine, but Nature contented her selfe to vse that already provided for the effusion of seede. Wherefore the necke of the bladder is carried vpwarde from the Fundament, vnto the beginning of the yard.

But because these offices are perfourmed by voluntary motion, it was requisite that it should also haue Muscles. It hath therefore diuers Muscles, of which no doubt *Galen* wrote precisely in his Books *de Anat. administrationibus*, but we haue lost fise Books and a halfe of that worthy labour, beside other peeces of excellent vse, as wee may gather by those that remaine. In the fifteenth Booke *de vsu partium*, he reckoneth but two Muscles of the yard, which saith *Vesalius* I could neuer finde. *Laurentius* describeth foure, so will we also according to *Baubine*. Two Collaterall on each side one, which do arise neruous from the appendix of the hips, [Tab. 4. fig. 1, 2, K L, in the first figure they cleaue to their originall, in the second they hang downe to their insertion] below the originall of the bodies whereof the yard

A strange thing observed by *Vesalius*.

The Muscles of the yarde.

Some of *Galen*'s workes lost.

Vesalius.

Laurentius.

Baubine.

Two collaterall musles.

yarde is made; afterward they become fleshy, short and thicker then those that follow; and being obliquely carried vpward, they are inserted into the bodies of the yarde not far from their originall [Table 4. fig. 2. c c] and being together contracted in the act of generation, doe bend the yarde and sustayne it whilest the worke be performed; as for the erection it selfe, we haue sayed before it is made by a voluntary constriction of the sphincter muscle of the fundament, driuing the blood and spirits vnto it. *Columbus* also saith that these muscles haue some vse in our making water.

Columbus.

2. Inferior.

The other two muscles of the yarde are called *inferiores*, because they are scituate vnder the pipe, [table 4. figure 1. 2. H I. in the first figure they appeare yet cleauing vnto it, but in the second they hang downe from their originals] on each side one, arising fleshy from the sphincter of the fundament. [table 4. figure 1, M] They are somewhat long, and are on their insides vnited and so carried along directly vnder the Canale, and implanted at the sides [table 4. figure 1, G] of the same, (and being diuided one from another, doe a little embrace the bodies of the yarde) that they may dilate the lower part of the Canale on both sides drawne downeward, the yarde remayning erected, and so make it shorter least in the repletion of the neruous bodies, especially in the oblique reflexion of the yarde, that passage should be stifled and so the issue of the Seede hindered, which comes indeed leaping forth, and yet is continued one part of it with another as a company of Antickes holding hand in hand, do vault vpon a stage.

Comparison.

The vses of the
Muscles.

Moroouer these muscles do presse the Prostate glandules [table 4. figure 3. and 7. RR] and straine the Seed that filleth them in the time of eiaculation through their membranes by graines as wee sayed before, into the Canale where they are all mingled and issue together.

In miction also or making of water the muscles haue their vse; for some say they distend the passage as *Vesalius*, others as *Palopius* and *Archangelus*, that in the end of miction they expresse or driue out the reliques of the vrine which remained in the end of the necke of the bladder. But if they worke all foure together, they draw the root of the yarde, which as well as the body thereof hath a power or faculty of erection.

Where they
cut for the
stone.

A story.

A caueas for
Chirurgions.

The vessels of
the yarde.
Veines.

Betweene these muscles in the *Peritoneum* [tab. 4. Figure 1, betweene M and H] or distance betweene the Cod and the Fundament are the stones of the Bladder taken forth. They call the place also *inter-feminium*, and in it Fistules and other vlcers are very ordinary. I saw a Knight of Lincolnshire of good place suddenly perish within few dayes of a gangrene new risen in this place, & it was credibly told me that his Father a Knight likewise, about the same age of his life was in the same place taken sodainely after the same manner and so perished. Wherefore this place is diligently to be considered of before a Chyrurgion worke vpon it.

The vessels that come to this virile Member are of 2. sorts, some outward others inward. The outward veines and arteries [table 8. Lib. 3. 11] arise from the veine and arterie called *Pudenda*, and are distributed through the skin. They are many and sometimes blackish like vnto bodden, bursten or varicous vessels.

The internall veines are double, and spring from the veine called *Hypogastrica* [table 8. lib. 3. 11.] These when they come vnto the middle bifurcation at the Crotch, doe almost alwayes vnite into one, which is carried along the body of the member in the middest among the arteries. From this veine a notable branch atteyneth into the capacity or cauitie of the *Abdomen*, and is disseminated through a Ligament which tyeth the bladder to the share-bones.

Arteries:

Vesalius?
Columbus?
Archangelus?

Bauhine con-
siste:

In like manner two internall Arteries and those very notable are inserted into the bodies of the yarde, from the Artery called *Hypogastrica* [table 8, lib. 3, 11] at the beginning of the Bifurcation of the same. The inuention of these arteries *Vesalius* attributeth vnto himselfe, as also the demonstration of their vse, whome *Columbus* taxeth; but *Archangelus* auoucheth that all the three sortes of vesselles in the yarde are so conspicuous that hee that is halfe blinde may see them; for being nourished, sayeth hee, why should it not haue veines as well as other parts; liuing why should it not haue Arteries, and mouing why should it not haue Nerues? *Bauhine* is of another minde, to wit, that the arteries are the vehicles of his nourishment which is thicke blood, and that the same arteries doe also deriue vnto it the mouing faculty, but of that more hereafter. We will return. Betweene the forenamed arteries in the middest passeth a veine through the backe of the yarde euen to the Nutte or glans, where it is implicated or foulded together with a nerue (which haply make the substance of

of the Nutte
yarde when
It hath also
Galen also in
proceede for
passe into the
others are inw
bone through
justly disperse
back, as farre a
it is of most v
tumor which w
seth it, yet not
like a Rams ho
but only grow
Finally, the v
looketh alway
the whole train
or cupping gla
smooth, and ru
ing his roundne
or the Nut of th
not offend the w
for the orifice o
ther with the in
matter of procr
It is couered w
did encompass
heads of the tw
hollow within.
But that it mi
skin of the yarde
cal root, *Galen* in
we call it the fore
coition it is moor
create the pleasur
without good rea
God of Nature, h
This fore-skinne
not be drawne ba
the Nut is vncou
part with a mem
vinculum carnis
ment, others will
which bridleth or
also furthereth the
the prostate gland
lustfull disports or
nearly issue forth
his finger, the stom
tuneth the *crapula*
In the middest of
is powred forth, so
femly is contracted
might procure mor
caused by the acin
vicers.
The vse of the yar

of the Nut fungous) all which conuey bloud and spirits into the spongy substance of the yard when it is prouoked or chafed.

It hath also Nerues so notable saith *Falopius*, that he that hath but halfe an eye may se the; *Galen* also in his 14. book *de vsu partium* and the 13. Chap. taketh knowledge of them. They proceede from the marrow of the great or holy bone, of which some that are cutaneous doe passe into the skin of the yard & the Testicles, to make them sensible of outward iniuries; others are inward, on each side one and that very notable, which ascendeth vnder the share-bone through the middle bifurcation to the coate of the yard, and from thence runneth diuersly disperfed to his muscles & to his whole body, together with the arteries through his back, as farre as to the Nut or glans, to giue it a more exact sence, especially the Nut where it is of most vse to stirre vp pleasure in the act of generation. In these Nerues hapneth that tumor which we call *ganglia*, that is a knotty tumor of a sinew resisting the finger that presseth it, yet not dolorous, which *ganglia* here are the cause that when the yard is erected itisse like a Rams horne as *Falopius* speaketh, it is not distended beyond his ordinary magnitude, but onely groweth full and turgid.

His nerues.
Falopius.
Galen.

Ganglia what
they are.

Finally, the vpper part of the yard is carnos or fleshy [Table 4. fig. 1, 2, 3, 4, 5, 7, 9. D] and looketh alwayes as if it were swollen; and indeede it hath a greater compasse then any part of the whole trunk (as *Archangelus* calleth it,) of his body, that like the bottome of a glasse Stil or cupping glasse, it might gather more heate vnto it selfe then any other part. It is equall, smooth, and turbinated, that is, broad at the basis or bottom, and growing smaller yet keeping his roundnes even to the top, much like a Turkes cap or turbant, and it is called glans or the Nut of the yard, and it is girt with a circle like a crowne. It is very soft that it might not offend the womb, somewhat acuminated or sharpned also at the top the better to fit it for the orifice of the matrixe; of exquisite sence it is, that in the attrition and motion, together with the intention of the imagination (which is most powerfull in both sexes in the matter of procreation) the seede might be more plentifully eiacted.

The glans or
nut of the
yard.

His figure.

Substance:

It is couered with a fine membrane, produced from that membrane which we said before did encompassse the pipe or Canale; and it groweth not vnlike to a mushrum vpon the heads of the two bodies of the yard. It is as we sayed of a spongy substance, which yet is not hollow within, but somewhat more solid and firme then other ordinary spongy bodies.

His membrane.

But that it might be kept smooth, soft and glib, it hath a couering which ariseth from the skin of the yard brought forward, and againe reflected or returned, which the Gracians call *proth*, *Galen* in his 15. book of the *use of Parts* calleth it *Cutis epiphysa*, in Latin *praputium*, we call it the *fore-skin*; that part which hangeth ouer the end is called *apophysis*, because in coition it is mooued vp and downe, that in this attrition it might gather more heate and increase the pleasure of the other sexe. Some say it was ordained for ornament also, and not without good reason, because vpon the more dishonest part, God & Nature, or rather the God of Nature, hath put the more honour, that is, the more couering.

The prepuce
or foreskin.

This *fore-skinne* in the end of it is sometimes so contracted or drawn together, that it cannot be drawne backe, nor the Nut discovered without the helpe of a Chirurgion. But when the Nut is vncovered, that it may recouer his couer againe, this prepuce is tyed in the lower part with a membranous band or tie, which the Greeks call *χαλινόν* some *κώρυ* and *κυνόδεσμον*, *vinculum caninum*, the Latines *frenum*, in English the bridle. *Archangelus* calleth it a Ligament, others will haue it to be made of the extremities or ends of the sinews, and this is it which bridleth or reyneth vp the fore-skinne on the lower side to the toppe of the Nut. It also furthereth the profusion of seede, communicating by the Canale motion and heate to the prostate glandules which containe the seede ready for eiactation. For oftentimes in lustfull disports or imaginations, if this bridle be but lightly moued the seede will incontinently issue forth; even as after a full meale, if a man but touch the end of his throate with his finger, the stomach by reason of the continuity of the parts, contracteth it selfe and returneth the *crapula* or vndigested gobbets into the lap by vomit.

In the midst of this Nut is a passage or hole through which both the seede and the vrine is powred forth, for it compasseth the common Canale at which place it is larger but presently is contracted againe, that the seede hauing there a kinde of momentary stay or stop, might procure more pleasure in this part. Wherefore those that labour of the *gonorrhoea* caused by the acrimony of rotten seed heaped vp in this large place, are here tortured with vlcers.

The vse of the yard is as hath beene saide in the particular parts thereof; only we will add, that

The vse of it,

that

that the auoiding of vrine was not the cause of the making of this member: (For we see women make water without it) but for procreation. Euen as Nature hath ordained the nose for smelling, yet she vseth it secundarily for purging the mucous excrements of the braine. So vpon a second intention this member serueth to deriue away the vrine wherewith otherwise we should lightly defile our selues.

And thus much shall suffice for the parts of Generation in men, wherein I haue bin indeed as particular as the Anatomical History did require, but yet withall hope I shal finde pardon, because the Reader may perceiue (at least if he haue any knowledge) that I haue pretermitted many secrets of Nature, which I could and would heere haue somewhat insisted vpon, if I had imagined that al into whose hands this work should come had bin competent and fit auditors for such kinde of Philosophy.

CHAP. IX.

Of the proportion of these parts both in Men and women.

The same parts of generation in men and Women.

Virgil. 1. Geor.

The wonderful prouidence and wisdom of God.

To bring a kind of eternity out of imperfection.

The particular parts of generation in Women.

Galen. The wombe is like the scrotum.

The neck of the wombe like the virile member.

The cause of the procreation of a woman.

It was the opinion of Galen in his 14. book *de vsu partium*, and the 11. chap. that women had all those parts belonging to Generation which men haue, although in these they appeare outward at the *Peritonaeum* or *interfemininum*, in those they are for want of heate retained within; for seeing a woman is begotten of a man, & perfect also in makind (for natures imperfections are not so ordinary) it is reasonable that the substance, yea and the shape of the parts in both sexes should be alike, as comming from one and the same set as it were of causes. Neither is it so vncommon in Nature, that those parts which in some creatures are prominent and apparent, should in others be veiled and couered: for Moles indeede are not without eyes, but haue them lying deeper in their heads & ouerco- uered, whence Virgil saith, *Aut oculis capti fodere cubilia calpe,* that is;

Or hood-winkt Moles haue dig'd their Bowers.

So we call captiues, not those which are not at al, but which are in restraint or in bands. Although heerein Nature hath excellently acquitted her selfe, that the abatement of naturall heate, which in men is the onely naturall and necessary cause of their dissolution, should so admirably become in women the originall of generation, whereby wee should attaine a kinde of eternity euen of our bodies, against the destined corruption of the matter, arising from an importunate discord of contraries. For so it pleased the Diuine Wisedome to create for the eternall soule (the most excellent of al formes) if not an eternall habitation heere, yet so absolute & admirable a structure, as might so long be perpetuated below, till it come to be eternized aboue after an ineffable manner of recreation.

Wherefore to return. In this other sexe, there are some parts which bring down the matter of seede out of the whole body, to wit, the spermaticall veins and arteries; others worke & labour it into good seede, as the body called *Varicosum* and the testicles; others leade the perfected seede, called as in men *vasa deferentia* or leading vessels. Lastly, the womb or Matrixe which receiue the seede together with the mans, retaineth it, and worketh vpon it for the generation and preservation of mankind. This womb is likened by Galen in his 4. book *de vsu partium*, and the 6. chap. to the *scrotum* or cod of a man [tab. 11. fig. 1.] as if the cod were but a womb turned the inside outward, and hanging forth from the Share-bone; and *Archangelus* maketh no other difference betweene them but of scite and insertion. For if a man doe imagine the cod to bee turned and thrust inward, betwixt the bladder and the right gut, then the testicles which were in it will now cleaue to it outwardly on either side, and so that which was before a cod will now be a perfect Matrixe.

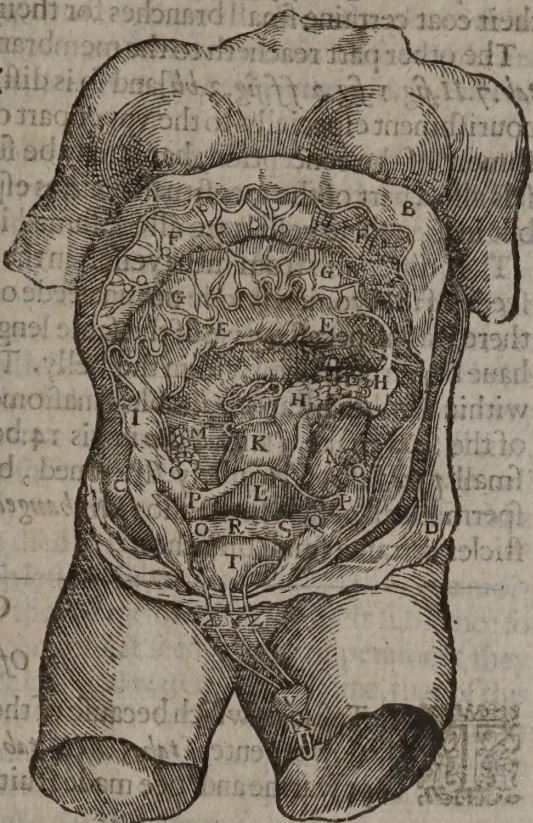
Againe, the necke of the wombe (saith he) is in stead of the yard, for they are both of a length, and by friction and refraction the seede is called out of the like parts, into the same passage, onely they differ in scituation which is outward in men, inward in women. *Fallopins* frameth the comparison of the parts somewhat after another sort, as we shall see heereafter when we come to the Controuersies.

So then, in the first conception or soone after, whether it be in a man or woman, the same Members are generated, but the fruite prooueth male or female, because of the temper of the seede and the parts of generation, either by heat thrust out, or for want or weakenes of the heate retained within: wherefore a woman is so much lesse perfect then a man by how much her heate is lesse and weaker then his; yet as I saide is this imperfection turned vnto perfection, because without the woman, mankind could not haue beene perfected by the per-

Table 5. sheweth the lower belly of a woman, the guts being taken away.

TABVLA V.

- A, B, C, D.* The inner face of the *Peritonaeum* reflected.
EE. The part of the *Mesentery* which ioyneth together the small guts.
FF. The Membranes of the *Mesentery* diuided asunder.
GG. The course of the vessels and Glandules in them.
HH, I. That part of the *Mesentery* which tyeth the right and the left part of the Collick gut.
K. The right gut cut off.
L. The bottome of the wombe whole.
M, N. Both the Testicles.
OO, QQ. A Membrane of the *Peritonaeum* which tieth the wombe; her vessels and the Testicles vnto the backe, it holdeth vp the wombe, and with the Membrane of the other side, it maketh the seconde coate of the wombe.
PP. Flethic Fibres which runne into this Membrane, making the right and left Muscles of the wombe.
R S. The necke of the wombe betweene *R* and *S*, couered yet with that Membrane.
T. The backe side of the bladder.
V X. The Nauell, with part of the Vmbilicall veine at *X*.
T. The Ligament of the bladder in brute Creatures, *V*.
ZZ. The two vmbilicall Arteries.



perfecter sexe. The great Maister workman therefore of set purpose, made the one halfe of mankind imperfect for the instauration of the whole kind, making the woman as a receptacle of the seede of which a new man was to be created. We haue therfore in this 5. Table exhibited the lower belly of a Woman, and remooued the guts that all thinges might bee more conspicuous; but now let vs come to the particular parts in a woman, beginning first with the spermaticall vessels.

CHAP. X.

Of the preparing Spermaticall vessels.

THe Spermaticall vessels which bring the seede from the whole body, and prepare it for further vse, are foure: Two Veines, & two Arteries. *Galen* in his book *de disse-*
ctione vteri, maketh mention of foure other vessels obserued by *Herophylus* in some women, which arise (saith he) from those vessels which go vnto the kidneies, and so passe in-
 to the womb, which saith *Galen* I could neuer finde in any creature, but onely in Apes. The
 right vein buddeth out of the [tab. 6. ad] trunk of the hollow vein below the emulgent, neere
 the great or holy bone; the left proceedeth [tab. 6. ee] from the left emulgent, because on this
 side the great Artery is scituated neere the hollow veine, which artery mooueth or bea-
 teth continually, so that if this left spermaticall vessel had proceeded out of the trunk of the
 hollow vein, it must of necessity haue bin carried ouer the great artery, & then this thin vein
 had bin in continuall danger of breaking by the incessant motion of the Artery.
 But both the Arteries [tab. 6. gb] arise from the trunk of the great Artery vnder the emul-
 gent neere the great bone, and are full of sprightfull blood. *Galen* recordeth, that *Aristotle* &
Erasistratus thought they contained nothing but spirits, with whom *Bonacciolus* & *Mercatus*
 seeme to consent. And although these haue the same originall with the arteries of a man,
 yet do they not, as in men, fal out of the *Peritonaeum*, neither reach vnto the share-bones (for
 it was not needfull that women as men should cast their seede out of themselves, but onely
 into their matrix) neither are they mingled together, or grow one into another before they
 come vnto the testicles, although *Vesalius* would haue it so. Wherefore they vary in their in-
 sertion and diuision. For in women they are supported with fat membranes [tab. 7. fig. 1. EE]
 and so are carried to the testicles [tab. 6. ii; tab. 2. fig. 1. F] but before they come there, after
 an inoculation or Anastomosis made between the veine and the artery, they are diuided

The spermas-
ticall Veines

The sperma-
ticall Arteries.

Diuided into
two parts.
The first.

The second.

How they dif-
fer from the
arteries in
men.

The Parastate
in women ve-
ry small.

saith *Galen* in his 14. book *de vsu partium* and chap. 9. into 2. parts; one part maketh the se-
minary vessell [tab. 7. fig. 1. *IK*] and the *corpus varicosum*, communicating to the testicles and
their coat certaine small branches for their nourishment.

The other part reacheth to the membrane cleauing to the bottom of the womb, [tab. 6. *ll*,
tab. 7. *H*, fig. 1. fig. 2. ff, fig. 3. *bb*] and so is distributed into the sides of the matrix, and carrieth
nourishment especially to the vpper part of the bottome or soale of it; as also for the nour-
ishment of the conception, that it may be fitly cherished with laudable blood; by which ves-
sels also a part of the mensuall courses especially in women; but not with child, is purged,
but in men these vessels are all consumed into the *corpus varicosum*.

They differ also from mens vessels in the shortnes of their course or way: for because the
seede of the women stood not in neede of so great elaboration as the mans did, therefore
there was no necessary vse of the same length; beside if they had been so long they could not
haue beene contained within the belly. These vessels being enfoulded and enwrapped one
within another by an admirable Anastomosis or inoculation for the *delineation or perfection*
of the seed, make (saith *Galen* in his 14. book *de vsu partium* the 14. chapter) if any, yet very
small *parastate* and scarcely discerned, because the Testicles themselues are small and the
spermatieall vessels small also: *Archangelus* saith that from these vessels goe vnto the Te-
sticles certaine small branches.

CHAP. XI.

Of the Testicles.

The Testicles which because of the in-bred coldnes of women are included within
the lower venter [tab. 5. *MN*, tab. 6. *ll*, tab. 7. fig. 2. *ii*, fig. 3. *ff*] that they might bee
kept warme and bee made fruitfull, doe lye one on either side at the sides of the

Table 6. sheweth the lower Belly the Guts being taken away, as also the Stomacke, the Mesentery, and some
Membranes, that the vessels seruing for generation may the better bee discerned. Also the Breast or Dug of a
woman excoriated, is here exhibited.

TABVLA VI.



- A, B, C, D*, The Peritonaeum reflected or returned backward, above & below.
E, F, The gibbous part of the Liuer *E*, the caue or hollow part *F*.
G, The trunk of the gate veine.
H, The hollow veine.
I, The great artery.
K, The rootes of the *Caeliac* artery which accompanieth the gate veine.
L, M, the fatty veine going to the coat of the kidneyes.
N, O, The fore-part of both the kidneyes.
P, Q, The emulgent veines and arteries.
aa, The right vterer at the lowest *a*, cut from a part which neere to *b*, stick-
eth yet to the Bladder, because the bottome of the Bladder is drawne to the
left-side.
c, The left vterer inserted into the Bladder neere to *r*.
dd, The spermatieck veine which goeth to the left testicle marked with *i*.
ee, The spermatieck veine which goeth to the left testicle marked with *i*, also.
f, The trunk of the great artery from whence the spermatieall arteries do
proceed.
g, h, The spermatieall arteries.
ii, The two testicles.
ll, A branch which from the spermatieck vessels reacheth vnto the bottome
of the wombe.
mm, The leading vessell of the seed which *Falopius* calleth the *tuba* or trum-
pet, because it is crooked and reflected.
n, A branch of the spermatieck vessell compassing the leading vessell.
oo, A vessell like to a worm which passeth to the wombe, some call it *Cremaster*.
p, The bottome of the wombe called *fundus Vteri*.
q, A part of the right gut.
r, s, The bottome of the Bladder whereto is inserted the left vterer, and a
veine ledge from the necke of the wombe neere vnto *r*.
t, The necke of the Bladder.
u, The same inserted into the priuity or lap.
v, A part of the necke of the wombe about the priuity.
yy, Certaine skinnie Caruncles of the priuities in the midst of which is the
slit, and on both sides appeare little hillocks.
The Figures belonging to the Dugs or Breast.
aa, The veins of the Dugs which come from those, which descending from
the top of the shoulder, are offered to the skin.
b, The veins of the Dugs deriued from those which through the arme-hole
are led into the hand.
c, The body of the Dug or Breast.
dd, The kernels and fat betwene them.
ee, The vessels of the Dugs descending from the lower part of the necke called
ingulum, under the Breast bone.

matrix

matrix [Tab. 5. L, sheweth the bottom of the womb, & MN the Testicles: tab. 6. P sheweth the womb, and ii the Testicles, Tab. 7. Fig. 2. & 3. c sheweth the wombe, and i, ff. shew the Testicles] about the bottome in women not with child, but in those that be, they are about the place where the hanch-bones are ioyned to the great or holy-bone, and are contained in loose membrans, [tab. 5. OO 2Q, tab. 7. fig. 1. EE, tab. 10. MN] arising from the *Peritoneum* which cover al-

The position
of the testicles.

to the middle part of the Testicles. They differ from mens testicles in scituation, for they lye vpon the Muscles of the loynes within the *Abdomen*; in Figure because they are not so thicke or round, but before and behinde broad and flatted; [tab. 7. fig. 2. ii] their vpper face is vnequall as if they were many small glandules [tab. 7. fig. 2. ii] (like the glandules of the Kell and Mesentery saith *Vesalius* and with him *Platerus*) and those vnequall (for some are greater and some are lesser) ioyned together. Long they are [tab. 7. fig. 1. F, fig. 3. ff] sinous or hollow, and beside small textures in the vessels themselves, they abound with a waterish humor like the thickest whay: In haile women they are full of this liquor, in those that be sick like bladderets filled with a watery humor, sometimes cleare, sometimes of a yellow or saffron colour and of very euill sent, from whence is often caused the strangulation or suffocation of the matrix, which we call fits of the mother. *Vesalius* telleth two tales of two women in whose testicles he found a very noysome and ill sented humor, one of which died in such a fit.

How they dif-
fer from mens
in scituation.
The Figure.
Platerus.

The suffocatis
of the matrix.

In the con-
tents.

Magnitude.

Vesalius.

Temperament
Man like a
lump of down.

Womens seede
water, mans
fire.

Hippocrates.
Hippocrates
meaning.

They differ in
their coates.

The vse of a
womans testi-
cles.

They differ also in magnitude for they are much lesse in substance, because they are moi-ster and softer, yet *Vesalius* thinks they are harder then in men. Neither is their substance so compact, because they were to ingender a more imperfect seede. In Temperament they are colder, whence womens seed is more moyst, thinne and waterish. Imagine, that of this thinnes as it were of water, and of the seede of the man which is thicker as it were of flower a certaine paste is made and in the wombe fermentated or wrought vp into the forme of a man; or because *Hippocrates* sayth that man consisteth of water and fire, we may say that the seede of the women is the water, and that of the man the fire, because as the fire it carrieth in a small body or matter, a great deale of actiuitie or forme; although I am not ignorant that this of *Hippocrates* is and may bee otherwise taken, as that both the seeds are the water, and the spirit is the fire; which Nature by the helpe of an aduentitious heate doth extract and segregate from the more excellent part of the seed, especially of the man, lying before hid in the power or possibility of the matter, which is called by Scholers *potentia materia*, which spirit assisted by the formative faculty of the wombe, doth with a discerning iudgement deduce and distinguish into proper acts the power or possibility of the parts mixed together confusedly in the masse of seed. This spirit also moueth & illumineth al the parts and moderateth all the actions of mans life, of which it is also chiefe cause. And therefore it is that we say, that the seed of a man is the actiue principle of the body, that of women but the passiue, or at least far lesse actiue then the other. But if the seed of both sexes had beene thicke, glewy & compact, they could not haue beene so perfectly mingled. Finally, they differ in their coats or coverings, for they haue but one, [tab. 7. fig. 1. K] because being conteyned in a hidden and safe place they needed no more: that coate *Galen* calleth *dartos*, and it is thinner & softer then that in men, but cleaueth to the testicles very strongly, as if it were one body with them. This coat also receiue the vessels of seed, & inuesting their substance containeth it or holdeth it in. The productions also of the *Peritoneum* doe incompasse only the middle part of the testicles where they receiue the spermaticall vessels.

The vse of the testicles, as say *Columbus*, *Archangelus*, *Laurentius* and *Baubine*, is by their inbred power to make the seed fruitfull. *Falopius* is not of this mind, *Platerus* halteth betwixt both; but we know assuredly that those women whose testicles are ill disposed are barren & vnfruitfull: for women as well as men do yeeld seed, but cold, though *Aristotle* deny it in his first book *de gener. Animal.* and the 20. chapter, who would haue that humour which is auoided by the neck of the matrix not to be a seminary or feedy humor, but a proper humor of the place, to wit an excrement of the womb, which also should be found in some, but not in others; as especially browne or swart coloured and mannish women. But *Hippocrates* in his 1. book *de diata*, and in his book *de natura pueri*; & *Galen* in his 14. book of the *vse of parts* and the 11. Chap. haue taught, that to perfect generation there is required a concurrence and mixture of the seeds of both sexes; and a place wherein (the forme of the parts being onely in power present,) the seede might be brought into act, such is the wombe; of which we shall heare by and by.

CHAP. XII.

Of the vasa deferentia or Leading vessels.

Laurentius &
a Castro
Pinaus



He vessell which leadeth the seede is on either side one [Table 6. mm. tab. 7. fig. 1.*, fig. 2. gg. fig. 3. gg] which Laurentius and Rodoricus a Castro would haue to arise from the preparing vessels, Pinaus from the Testicles. It is said to be sustained by the Li-

The first Figure sheweth the wombe cut from the body, with the vessels which grow vnto it, the Testicles, the Bladder and the Membranes: the necke of it is turned upward, that the orifice of the bottome of the wombe may the better be perceived: the bladder also is opened, that his cavity and the insertion of the Vreters may better appeare.

The 2. Figure sheweth the wombe with his vessels parted from the Membranes and the Bladder.

The 3. Figure sheweth the wombe freed from all the vessels excepting the spermaticall vessels, where also the forme of the Trumpet is omitted.

The 4. Figure sheweth the womb cut out of the body, & the thickness of his coates in a woman with childe; and the cleft of the lap or priuity dilated or laide open.

The first Figure.

- A, The bottome of the wombe laide open without any Membrane.
- BB, The necke of the wombe turned vpward.
- CD, A part of the bottome of the wombe like the nut of the yard, swelling into the vpper part of the necke of the wombe, in the middle whereof the orifice appeareth.
- EE, A Membrane knitting the wombe to the Peritonaeum, and holding together the vessels thereof.
- F, The left testicle.
- G, The spermaticall veine and artery.
- H, A part of the spermaticall vessels reaching vnto the bottome of the wombe.
- I, One part of the vessels comming to the testicle.
- K, A vessell leading the seede vnto the wombe.
- L, The coate of the testicle with the implicatio of the vessels.
- M, The cavity of the Bladder opened.
- N, The insertion of the Vreters into the Bladder.
- O, The Vreters cut from the Kidneyes.
- P, The insertion of the necke of the bladder into the lap or priuity.

The second Figure.

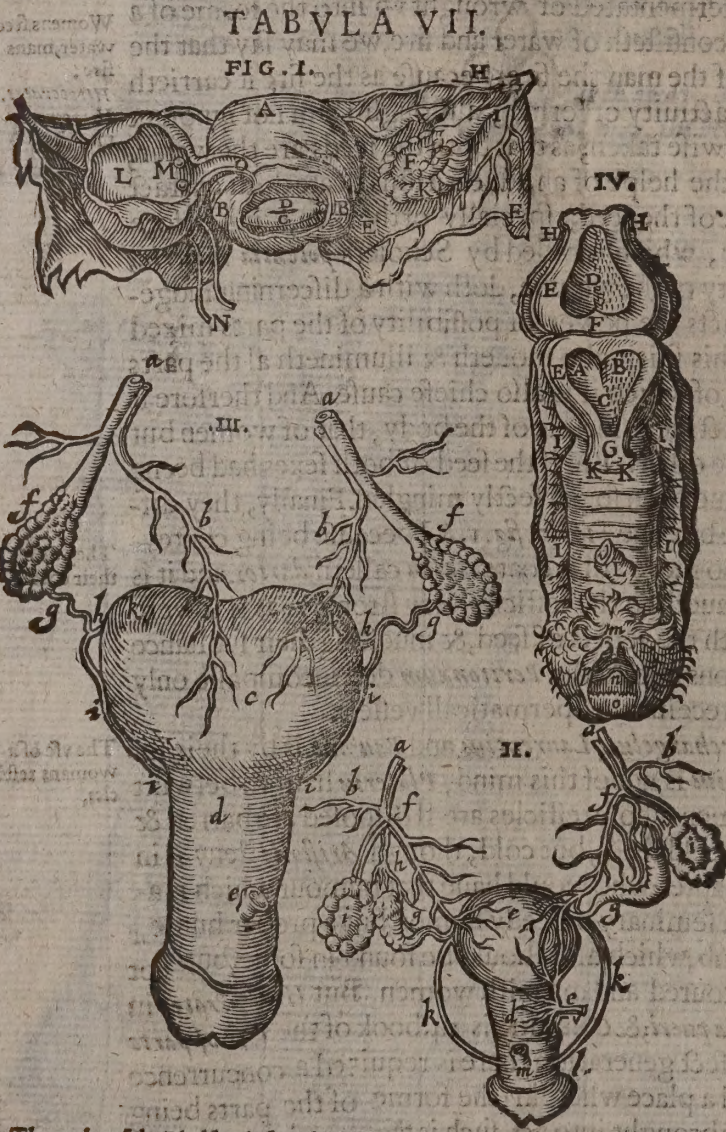
- aa, The spermaticall Veine and Artery.
- bb, Branches distributed to the Peritonaeum from the spermaticall vessels.
- c, The bottome of the wombe.
- d, The necke of the wombe.
- e, Certaine vessels running through the inside of the womb, and the necke thereof.
- ff, Vessels reaching to the bottome of the wombe produced from the spermaticall vessell.
- gg, The leading vessell of seede called Tube the Trumpet.
- hh, A branch of the spermaticall vessell compassing the Trumpet.
- ii, The Testicles.
- kk, The lower Ligaments of the wombe, which some call the Cremasteres or hanging Muscles of the wombe.
- l, The lap or priuity into which the Cremasteres do end.
- m, A portion of the necke of the bladder.

The third Figure.

- aa, The spermaticall vessels.
- bb, A branch from these spermaticall vessels to the bottome of the wombe.
- cc, The body or bottome of the wombe.
- d, The necke of the same.
- e, The necke of the bladder ending into the necke of the wombe.
- ff, The testicles.
- gg, The leading vessels, commonly though not so well called the ejaculatory vessels.
- hh, The diuision of these vessels, one of them determining into the hornes at double kk.
- ii, The other branch ending in the necke, by which women with childe auoide their seede.
- kk, The hornes of the wombe.

The fourth Figure.

- AB, The bosome of the bottome of the wombe, at whose sides are the hornes.
- CD, A line like a suture or seame, a little distinguishing that bosome.
- EE, The substance of the bottome of the womb, or the thickness of his inward coate.
- F, A protuberation or swelling of the wombe in the middle of the bosome.
- G, The Orifice of the bottome of the wombe.
- HH, The coate or second couer of the bottome of the womb, comming from the Peritonaeum.
- III, A portion of the Membranes which tie the wombe.
- KK, The beginning of the necke of the wombe.
- L, The necke of the Bladder inserted into the necke of the wombe.
- m, The Clitoris in the toppe of the priuity.
- n, The inequality of the priuity where the Hymen is placed.
- o, The hole or passage of the priuity in the cleft.
- p, The skinny caruncle of the priuity.



L, The necke of the Bladder inserted into the necke of the wombe. m, The Clitoris in the toppe of the priuity. n, The inequality of the priuity where the Hymen is placed. o, The hole or passage of the priuity in the cleft. p, The skinny caruncle of the priuity.

gament of the wombe, as it were with a prop. Neruous it is and white, about the Testicle broad and large, [tab. 6. mm, tab. 7. fig. 1. * fig. 2. gg] (saith *Galen* in the 9. chap. of his Book *de dissectione uteri*.) membranous also, and a little complicated or folded like a small seminary bladder being rugous, such as in men is at the *prostate*. In the middle it hath a notable hole or passage like the mouth of a trumpet, whence *Falopius* calleth it the Trumpet of the womb, and saith it is found not onely in the bodies of women, but also of all female creatures, by which as by a breathing vent the smoky vapors of the womb do exhale into the capacity of the *Abdomen*; and this hole the spermatike vessels do compasse, [Tab. 6. n. 1, tab. 7. fig. 2. hh] and it is curled vp after the maner of a Vine tendril. For it is more rugous [tab. 7. fig. 3. gg] & fuller of windinges then it is in men, and that because of the shortnesse of the way, which is recompensed by the multitude of turnings, seing it could not passe through the production of the *Peritoneum*, because the Testicles did not hang out.

The trumpet
of the wombe.
Falopius.

How they dif-
fer from mens.

Their progres.

The hornes of
the wombe.

Which way a
womans seede
passeth after
she is conceiued.

Seed out of the
vessel grow-
eth poysonous.
Galen.

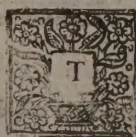
Varolius.

Why some
women have
more pleasure
then others
after concep-
tion.
Falopius.

These Leading vessels hauing passed the Testicles a little, become by degrees narrower, [tab. 6. mm, tab. 7. fig. 1. * fig. 2. gg] and are not carried as in men to the necke of the bladder, but to the wombe; and when they come to the sides of it, [tab. 7. fig. 3. kk] which are called the hornes of the wombe (from whence *Falopius* and *Platerus* think these leading vessels do issue) they are diuided on either side, [tab. 7. fig. 3. hh] and one part which is the shorter and larger, is implanted into the middle [tab. 7. fig. 3. k] of the horne of his own side, or neere vnto it; and powreth into it and into the hollownesse of the womb, seed perfectly boiled, but the other part which is narrower but longer [tab. 7. fig. 3. ii] is carried along the sides of the womb to his necke [tab. 7. fig. 3. d] on either side, and is inserted below the innermost mouth vnder the necke into the *Prostate*; which are not so conspicuous as they are in men, because the seede of a woman is not so corpulent or beareth not such a bulke. These keepe the seed till the time of coition, and by this way women with child in accompanying with men do loose seede, and not by the inmost mouth of the wombe opened. For whereas after conception the mouth of the wombe is exquisitely closed vp, [tab. 7. fig. 1. betweene C and D, and fig. 4. G] and yet euen then women in coition do loose seede; it is necessary the same should passe some other way, because the cavity of the wombe being on euery side filled, the seede that should come from the bottome or side of it cannot haue recourse vnto the orifice, or if it could, yet seeing that is so straightly stopped & must not be reclud or opened for feare of abortment, it would follow that the seed putrifying the Infant should perish. For seede when it is out of the vessels, cannot without great danger be retained, yea it becommeth very poyson, as *Galen* saith in his 6. Book *de locis affectis*, and the 5. Chapter, and we also may plainly see in the greuous fits of widdowes troubled with the Mother; wherefore this passage [tab. 7. fig. 3. ii] as *Varolius* rightly admonisheth must be in the neck of the womb, which in those that haue not conceiued is so small, that it cannot be perceiued vnlesse the Anatomist be very diligent and oculte: but in women with childe it is very large and manifest. Hence it is, that many women when they are with child, conceiue greater pleasure in their husbands then at other times, and also some women more then others. But *Falopius* is of opinion, that these Leading vessels doe arise from the sides [tab. 7. fig. 2. g] or hornes of the womb, & are caried vpward obliquely by the testicles but do not arise from them, because in sound and haile women they are distant from the testicles the bredth of a finger, neither that there appeareth any vessell which passeth from the testicles to these holes or passages, but are onely coupled together by a thin membrane produced from the *Peritoneum*, but do not so much as touch one another. But if the wombe be euill affected and that on one side, then the leading vessel is ioyned to the testicle on the ill affected side, but not on the sound; but if both sides of the wombe bee affected, then both the Leading vessels are ioyned with both the testicles.

CHAP. XIII.

Of the Wombe or Matrixe.



He wombe called *Vterus*, is by *Aristotle* called the Field of Nature, into which the seede as well of the woman as of the man, is partly powred partly drawne, to which accrueth the womans blood, that the new off-spring of mankind might bee ingendred, nourished, encreased, and kept to the due time of birth. For the

*Lib. 1. de gene.
A. inal. Cap. 2.*

Naturall

The forming
Faculty.

How all the
parts are for-
med at once.

The names of
the wombe.

The situati-
on & the rea-
sons thereof.

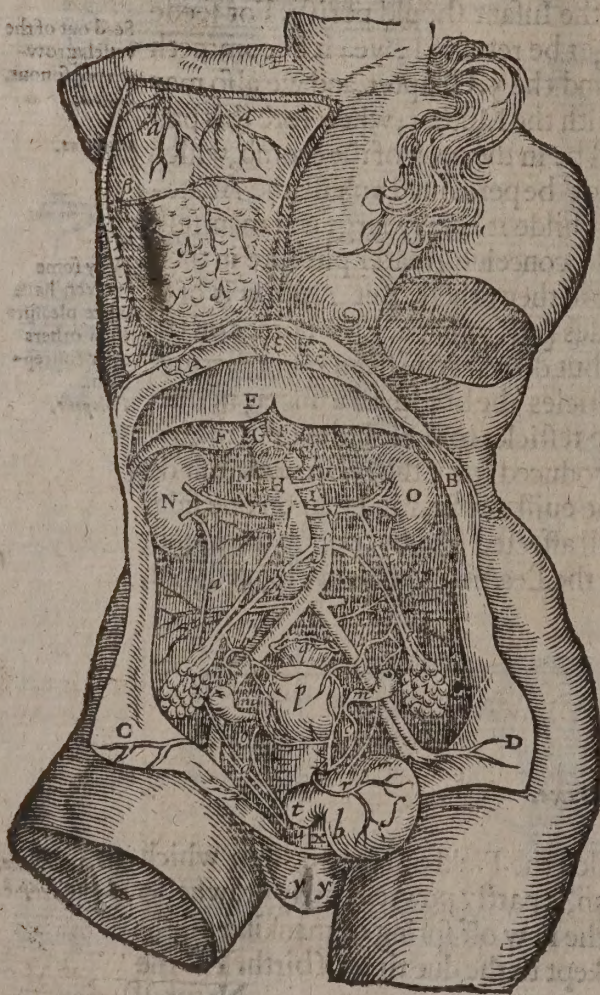
Naturall and vegetable soule which lyeth potentially in the seed, diffused equally through the whole masse, must be produced into act; and it is so produced by the vertue and heat of the wombe that receiued the seede, and the forming faculty which potentially consisteth partly in the seed of man, partly in the nature of the womb, and is called *vis plastica*, and so of both seeds mingled are framed and procreated equally together and at one and the same time all the parts of the body, but you must vnderstand their Spermaticall foundations and solid substance; as for their sanguine foundations or proper *Parenchymata*, they are procreated at diuers times, as they sooner or later get nourishment and fire, that is, spirit; and so those parts that are neerer to the Liuer are perfected before those that are more remote, and those first into which first the mothers blood doth flow, that is, first the vmbilicall vein, wherefore that is first absolued in his fleshy substance, from which afterwards the blood is led and conuayed into other parts.

It is called *Vterus* properly in women, because it is hollow like a bottle, and as a bottle or bagge of leather is filled and distended with the Infant contained in it; *Hippocrates* calles it *γυνή*; but most commonly the *Gracians* call it *ύστέρα*, because it hath the last place among the entralles or inwards; also *μύτρα*, *mater*, or the mother, because it is the mother of the Infant, some call it *vulua*, but that is properly in Beasts, as *Pliny* witneseth in the 37. chap. of his 11. Booke; it is called *locus* or rather *loci*, the place of a woman.

It is placed within the body [Table 5, L, tab. 8. p. tab. 10. L] because the seede after it is cast into the wombe, needed much heat to stirre it vp and to mooue it toward the delineation of the parts. In the lower belly (not in the middle or supream, for that these two are compassed with bones and cannot bee dilated according to the increase of the Infant, but would haue stifled it by compression;) because this is easily dilated as the burthen increaseth, and in the lower part of it called the watercourse or *Hypogastrium*, partly because it should bee no hinderance to the nutritiue parts, partly for the more commodious begetting and

Table 8. sheweth the lower Belly the Guts being taken away, as also the Stomacke, the Mesentery, and some Membranes, that the vessels seruing for generation may the better bee discerned. Also the Breast or Dug of a woman excoriated, is here exhibited.

TABVLA VIII.



- A, B, C, D, The *Peritonaeum* reflected or returned backward, above & below.
E, F, The gibbous part of the Liuer E, the caue or hollow part F.
G, The trunk of the gate veine.
H, The hollow veine.
I, The great artery.
K, The roots of the *Coliacall* artery which accompanieth the gate veine.
L, M, the fatty veine going to the coat of the kidneies.
N, O, The fore-part of both the kidneies.
T, V, The emulgent veines and arteries.
aa, The right vreter at the lowest A, cut from a part which neere to b, sticketh yet to the Bladder, because the bottome of the Bladder is drawne to the left side.
c, The left vreter inferred in to the Bladder neere to r.
dd, The spermaticke veine which goeth to the left testicle marked with s.
ee, The spermaticke veine which goeth to the left testicle marked with i, also.
f, The trunk of the great artery from whence the spermaticall arteries do proceed.
g, h, The spermaticall arteries.
ii, The two testicles.
k, A branch which from the spermaticke vessels reacheth vnto the bottome of the wombe.
mm, The leading vessell of the seed which *Falopius* calleth the *tuba* or trumpet, because it is crooked and reflected.
n, A branch of the spermaticke vessell compassing the leading vessell.
oo, A vessell like to a worm which passeth to the wombe, some call it *Cremafter*.
p, The bottome of the wombe called *fundus Vteri*.
q, A part of the right gut.
r, s, The bottome of the Bladder whereto is inserted the left vreter, and a veine led from the necke of the wombe neere vnto r.
t, The necke of the Bladder.
u, The same inserted into the priuity or lap.
x, A part of the necke of the wombe about the priuity.
yy, Certaine skinnie Caruncles of the priuities in the midst of which is the slit, and on both sides appeare little hillocks.
- The Figures belonging to the Dugs or Breast.
- aa, The veins of the Dugs which come from those, which descending from the top of the shoulder, are offered to the skin.
β, The veins of the Dugs deriued from those which through the arme-holes are led into the hand.
γ, The body of the Dug or Breast.
δ, The kernels and fat betweene them.
ee, The vessels of the Dugs descending from the lower part of the necke called *ingulum*, vnder the Breast bone.

bring-

bringing forth of the fruit. The den or cavity of the body wherein it is contained is called *Pelvis*, that is, the labour or bason; so that it is compassed about as with strong rampires for defence, with the share-bones before, the great bone behinde, and the hanch bones on either side. I speake of the wombe vnburdened, for then the bottome of it reacheth not higher then the beginning of the great bone, neither toucheth it anything but the right gut, [Tab. 5. K. Tab. 8. q.] vpon which it lieth, nor reacheth forward about the bladder; [tab. 5. 2, tab. 8. f] for it is placed betweene the bladder and the right gut, that backward it might haue, as it were, a pillow (saith *Galen* in the first chap. of his Book *de dissectione uteri*, and in the 14. Book *de usu partium* and the 14. chap.) betweene it and the backebone, that it might not be hurt by his hardnesse, and before it a strong membrane, to wit, the bladder as a bulwarke to defend it. Here we may see the glory of the ancient habitation or mansion house of mankinde, how that we are bred of a brittle and perishing substance betweene the excrements and the vrine, and must moulder againe into earth and dust, wherefore in the ruffe of our pride let vs seriously consider of that saying of *Pliny*, *Alas, how soittislye franticke is he, that imagines himselfe out of so meane and base beginnings, to bee borne to pride; but to returne to our History.*

The wombe is placed in the midst of the neather belly, that the body might bee equally ballanced, saith *Galen*, & for that cause the lauer or basen is larger in women, from whence also they haue larger buttockes then men.

But as the burthen increaseth, the womb in the vpper part (which is the bottome) being loose and at liberty groweth vpward to the nauill [tab. 10. l] & leaneth vpon the small guts, yea and fulfilleth al the places of the flaukes when they are neere the time of their deliuerance. Neither then doth it so directly keepe the middle place of the belly, but leaneth either to the right hand or to the left, according to the diuersity of the sexe of the infant, although this be not perpetuall. Sometimes there falleth some part of the kall betweene the bladder and the womb, and there causeth barrennes by the compression of the mouth of the womb, as *Hippocrates* conceited and expresseth in the 46. Aphorisme of the 5. section. It is knit partly by the very substance of it, partly by foure ligaments, whereof two are aboue, two bellow; but the bottom [table 8. p] before, behinde and aboue is adioyned to none of the adherent parts, but is loose, free and at liberty, that it might better be distended in women with child, and in coition when the desire of conception is, might more freely moue, now vpward then downward & open it selfe to the end of the yard, whence *Plato* in *Timaeo* calleth it *ζῷον ἀνιθρομνικόν*, that is, a crawling creature (so saith *Salomon*, *The barren womb neuer saith it is enough*), because in the conception it hath a kinde of Animal motion or lust to be satisfied; neither doth it onely moue it selfe in the lust of conception, but also it wil in a manner descend or arise vnto any sweete smell, and from any thing that is noysome: which is the reason that many women are so easily offended with the smell of muske or other perfumes taken at the nose, for that the wombe moueth vpward vnto them; and in the fit of the rising of the mother, we apply burnt feathers and such like noysome vapours to the nose to driue the wombe downward againe, as also sweete and odoriferous suffumigations below to draw it downward to the owne naturall seate.

At the sides it is tyed to the haunch bones by membranous ligaments [tab. 5. 00 20. tab. 10. l K. tab. 9. fig. 4 III] arising as *Galen* saith in his 4. Book *de usu partium*, and cap. 14. & in the 4. cap. of his book *de dissectione uteri*, from the Muscles of the loines; but we rather think (saith *Banbime*) from the *Peritoneum*, and may be compared to Bats wings [tab. 9. fig. 1. EE] These Ligaments are woven sometimes with fleshy Fibres (whereupon *Vesalius* and *Archangelus* haue named them Muscles) by whose helpe they being distributed into either part of it, the wombe is held stedfast. These Ligaments although they bee strong, yet are they some-what loose or laxe and softe, so that in no part there are found so laxe ligaments, the reason is, that they might better be extended with the wombe, and follow it also in the motions without dilaceration; for the wombe when it is filled is large and wide, but afterward is contracted into the quantity of a Peare or a halfe-peny purse.

These Ligaments also, as *Hippocrates* and *Plato* in *Timaeo* haue written, like to Bridles do hold in the wombe, which yet notwithstanding rideth as a moored Ship in a Tempest betweene her Anchors, especially in barren women, sometimes vpward to the Liuer and Midriffe, and compressing them it bringeth a feare of suffocation; sometimes downward, bearing toward the hips, and causeth in them great paine, but especially it troubleth the left side, whence it is that we obserue that those women which beare vnprofitable burthens

A remembrance
for proud men.

Pliny.

Where it groweth.

A cause of
barrennes;

Hippocrates

The connexi-
on.

The wombe a
crawling crea-
ture.

Plato.

Salomon Prover-
bs 30. 15.

An obseruati-
on of the vse of
sweet & stink-
ing smells for
women.

Of the condi-
tions of the
ties of the
wombe.

The quantitie
of the wombe

Simile.

A good obser-
uation for wo-
men.

do

The first Figure sheweth the wombe cut from the body, with the vessels which grow vnto it, the Testicles, the Bladder and the Membranes: the necke of it is turned upward, that the orifice of the bottome of the wombe may the better be perceined: the bladder also is opened, that his cavity and the insertion of the Vreters may better appeare.

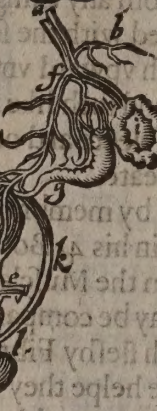
The 2. Figure sheweth the wombe with his vessels parted from the Membranes and the Bladder.

The 3. Figure sheweth the wombe freed from all the vessels excepting the spermaticall vessels, where also the forme of the Trumpet is omitted.

The 4. Figure sheweth the womb cut out of the body, & the thickness of his coates in a woman with childe, and the cleft of the lap or priuity dilated or laide open.

TABVLA IX.

FIG. 1.



L, The necke of the Bladder inserted into the necke of the wombe. m, The *clitoris* in the toppe of the priuity. n, The inequality of the priuity where the *Hymen* is placed. o, The hole or passage of the priuity in the cleft. p, The skinny caruncle of the priuity.

do especially complaine of greefe, paine, and gnawings in the left side, sometimes it beareth more downward, as in lustfull passions, and now and then compressing the necke of the bladder, it causeth strangulation.

How the
wombe moo-
ueth.

But wee must vnderstand that the wombe is not like a gadding creature that moueth out of one place into another, relinquishing her proper place, but is onely vnequally extended and againe re-called or drawne backe into it selfe from that extension, as when vpon the retention of the menstruall courses, there groweth a plenitude and so a distension of the veines and ligaments (for these ligaments as wee sayd haue fleshy fibres and are therefore some-

The first Figure.

A, The bottome of the wombe laide open without any Membrane.
BB, The necke of the wombe turned vpward.
C D, A part of the bottome of the wombe like the nut of the yard, swelling into the vpper part of the necke of the wombe, in the middle whereof the orifice appeareth.
EE, A Membrane knitting the wombe to the *Peritonaeum*, and holding together the vessels thereof.
F, The left testicle.
G, The spermaticall veine and artery.
H, A part of the spermaticall vessels reaching vnto the bottome of the wombe.
I, One part of the vessels coming to the testicle.
K, A vessell leading the feede vnto the wombe.
L, The coate of the testicle with the implication of the vessels.
M, The cavity of the Bladder opened.
N, The insertion of the Vreters into the Bladder.
O, The Vreters cut from the Kidneyes.
P, The insertion of the necke of the bladder into the lap or priuity.

The second Figure.

aa, The spermaticall Veine and Artery.
bb, Branches distributed to the *Peritonaeum* from the spermaticall vessels.
c, The bottome of the wombe.
d, The necke of the wombe.
e, Certaine vessels running through the inside of the womb, and the necke thereof.
ff, Vessels reaching to the bottome of the wombe produced from the spermaticall vessell.
gg, The leading vessell of feed called *Tuba* the Trumpet.
hh, A branch of the spermaticall vessel compassing the Trumpet.
ii, The Testicle.
kk, The lower Ligaments of the wombe, which some call the *Cremasteres* or hanging Muscles of the wombe.
l, The lap or priuity into which the *Cremasteres* do end.
m, A portion of the necke of the bladder.

The third Figure.

aa, The spermaticall vessels.
bb, A branch from these spermaticall vessels to the bottome of the wombe.
cc, The body or bottome of the wombe.
d, The necke of the same.
e, The necke of the bladder ending into the necke of the wombe.
ff, The testicles.
gg, The leading vessels, commonly though not so well called the *ciaculatory* vessels.
hh, The diuision of these vessels, one of them determining into the hornes at double kk.
ii, The other branch ending in the necke, by which women with childe auoide their feede.
kk, The hornes of the wombe.

The fourth Figure.

A B, The bosome of the bottome of the wombe, at whose sides are the hornes.
C D, A line like a suture or seame, a little distinguishing that bosome.
EE, The substance of the bottome of the wombe, or the thickness of his inward coate.
F, A protuberation or swelling of the wombe in the middle of the bosome.
G, The Orifice of the bottome of the wombe.
HH, The coate or second couer of the bottome of the wombe, coming from the *Peritonaeum*.
III, A portion of the Membranes which tyed the wombe.
KK, The beginning of the necke of the wombe.

some what more all it is but a hapneth by re times in anit seth it selfe al So haue v body, thole v thole vpon th that some ha make them self rose into the t fayed; that the Yet sometime of the birth th into the lappe a yarde betw selfe when the in our Treatise gloweth and f For it is no rience also of is no necessity for the propaga The necke o it groweth to backward it fa and a little fat with the funde vicerated a li it is tyed to of the womb is from the *Perito* (which is a vain the vpper ligam The lower Lig tion, are likewise hornes of the worms, reddish cavity is somet from the sides touch the leadin and are carried men, and passe tion being dilat hard bargames of which they are cu vnlesse they be w To these after hanch-bones, wh is, *hangery* up, of on with the Test vessels. These Ligamen and sinewy flende the fore-part of th that being Neruo nations are comm feede: although t

somewhat musculous and so subiect to some distention) and if it descendeth any thing at all it is but a very little; but when it is drawne vppward to the bottome of the stomack, that hapneth by reason of the conuulsion of the vessels, which is sometimes from repletion, sometimes inanition; not that the wombe is a living creature or hath voluntary motion, or ariseth it selfe about the stomacke.

So haue we seene in a generall, or by and by after a generall conuulsion of the whole body, those vessels so conuelled that the wombe hath pressed vppon the parts next vnto it, those vpon the midriffe, the midriffe vppon the lungs, the lungs vpon euen to the throate; so that some haue thought the partie to bee possessed of the foule fiend; some that would make themselues wiser, and should by right haue had more wit, haue sayd that the mother rose into the throate. But *Hippocrates* in his Booke *de articulis*, hit the nayle right when hee sayd; that the wombe of it selfe changeth not much his place, but is drawne by other parts. Yet sometimes what with the waight of the Infant, what with the difficulty and violence of the birth, the ligaments are so relaxed that the bottome of the wombe falleth downward into the lappe: sometimes also the necke is turned and it hangeth forth of the priuities like a yarde betwixt their thighes, that it must be taken away by the Chyrurgion, or fall of it selfe when the ligaments are putrified, as we shal hereafter haply more particularly declare in our Treatise of the accidents of the wombe in a worke of Chyrurgery, which now gloweth and sparkleth vpon the anuile.

For it is not to be doubted (say diuerse both Greekes and Arabians; beside some experience also of our owne times) but that a woman may liue without a wombe, because there is no necessity of it for the preseruacion of the particular or indiuiduall nature, but onely for the propagation of the kinde.

The necke of the wombe is tyed to the neighbour parts but not round about; at the sides it groweth to certaine membranes, and by their mediation is loosely tyed to the *Peritoneum*; backward it fasteneth to the great or holy-bone, and to the right gut with very thinne fibres and a little fat on which it lyeth all along his passage, and aboue the lap groweth into one with the fundament to which it is before vnited; so that sometimes when the fundament is vlcerated a little within, the excrements haue beene seene to fall out at the lappe. Before, it is tyed to the necke of the Bladder. [tab. 8. 1. tab. 9. fig. 1. O. fig. 4. L.] And because the neck of the womb is broder, part of it is tyed to the share-bones by the help of membranes arising from the *Peritonæum*, hence it is that in inflamations of the womb there followeth a *Tenesmus*, (which is a vaine desire or dolorous offer to the stoole,) and the strangury: and so much of the vpper ligaments of the wombe.

The lower Ligaments of the womb [tab. 8. 2. tab. 9. fig. 2. K.] of which *Vesalius* maketh no mention, are likewise two, which *Laurentius* calls *xpuaσnres*, *Columbus*, *processus uteri*; *Varolius*, the hornes of the womb: but indeede they are certaine neruous productions, round like to earth wormes, reddish, and hollow especiallie in their end like vnto the husky-membrane, which cavity is sometimes found to be filled with fat. These ligaments proceed on either hand from the sides of the womb [tab. 8. at p. tab. 9. at c] and in their beginning or originall they touch the leading [tab. 8. mo. tab. 9. fig. 2. g] vessels of the seede; thence they rise vnto the lesk, and are carried through the production of the *Peritoneum*, as the spermatike vessels of men, and passe through the Tendons of the oblique Muscles of the *Abdomen*. This production being dilated, when also the inward coate whereof it consisteth is first broken (as in hard bargaines of trauell it often hapneth) there falleth to Women as to Men a rupture of which they are cured by Ligature after section. But section in Men is not to be vndertaken vnlesse they be willing to lose their Virility.

To these after they are out of the *Abdomen*, are ioyned fleshy fibres comming from the hanch-bones, which make certaine small muscles called *xpuaσnres*, in Latine *suspensores*, that is, *hangers up*, of which *Vesalius* maketh no mention. These in Women haue no communication with the Testicles, albeit in Men they haue, because they adioyne to the spermatike vessels.

These Ligaments aboue the share-bone [Table 9. Figure 2. I] do degenerate into a broad and finewy slendernes (mingled as it were with a Membrane which toucheth and inuesteth the fore-part of the share-bone) vpon which the *Clitoris* cleaueth and is tyed; in so much that being Neruous and therefore of most exquisite sense, from his attrition lustfull imaginations are communicated to these Ligaments, and from these to the vessels leading the seede: although their vse also is, to hold the wombe suspended least it fall out of the lappe (like

A strange case like a possession in Marie Glouer of Thames street.

Hippocrates.

The cutting out of the wombe.

The ties of the neck of the wombe.

A good obseruation for women.

The lower ligaments. *Laurentius* *Columbus* *Varolius.*

The rupture in women how caused.

How cured.

Table 10. sheweth the portraiture of a woman great with Child, whose wombe is bared and the Kell taken away, that the stomacke, the guttes and the wombe might be better scene.

TAB. X.

A, B, C. The inner part of the *Peritoneum*.

EE. The embowed part of the Liuer.

FF. The Stomacke.

G, H. That part of the Collicke gut which runneth vnder the Stomacke.

I, K. The Membranes by which the wombe adhereth to the bones.

L. The wombe ascending as high as to the Nauell.

M, N. Coates arising from the *Peritoneum*, which compasse the Testicles, the vessels and the forepart of the wombe, and make the outward coate of the same.

O. The fore-part of the necke of the wombe.

P. The place of the bladder.

Q. The *Vrachus*, a Ligament of the bladder.

R R. The vmbilicall arteries.

S. The Nauell.

T. The vmbilicall veyne cutte from the Liuer.



The Vses of the ligaments

(like as the *Cremasteres* in men doe suspend the Testicles) to strengthen and corroborate it, as well because of the great burthens it carries often and long, as of the strong throwes in the birth, and the humours which doe flow thither out of the whole body, which doe not onely moysten the part, but also might very well relaxe it. Finally by how much these Ligaments haue more fleshy fibres wouen into them, by so much do they (sayth *Pinaus*) more leane to the office of muscles, helping the voluntary attraction of mans seede out of the necke into the cauity of the wombe.

The Figure of the wombe.

The figure of the wombe is round [table 8. p. table 9. figure 1. A. figure 2. c.] that it might bee the more capacious, and lesse obnoxious to iniuries; aboue, it is somewhat depressed [table 9. figure 3.] like the bladder, excepting the tops of it which they call the hornes. For in women with child, as in the bladder so in the womb, the bottome is long and the necke narrow; but in those that be not with childe the bottome is no broader then the necke. *Soranus* and out of him *Falopius* likeneth it to a pressed cupping glasse, both for the forme and also for the manner of attraction; for the seede of man cannot attaine vnto the bottome of the wombe vnlesse it be drawne. Taking it together with the necke it is very well compared by *Archangelus*, *Laurentius*, *Pinaus*, and *Bauhine* to a Peare. [tab. 9. fig. 3.] For the bottome downeward directly from the corners becommeth narrower by degrees euen to the beginning of the necke, which is like a long and round passage, yet so as that the bottome

Like a Peare. *Archang. Laur. Pinaus.*

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Table 11. the f
after birth clea
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sheweth the All
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FIG.



is of a figure most like vnto roundes as wee see in a good fayre Peare, whose bottome is round and bottle fashion.

The magnitude of it is not in all women alike, but differs according to the age, body, and impregnation or burthen. In Virgins that are growing it is smal and lesse then the Bladder; but in women grown it is greater; so in those that vse not mans helpe, and in old women because they are dried and withered, it is but little, (that it may the lesse trouble the neighbour parts) and thicke, not much broader then two fingers, and in length scarce euer so long as three (I meane the bottome,) seldome reaching about the share-bone and the Bladder. In full grown women it is greater, (yet those that haue neuer conceived are much like to virgins) because there is present vse of it; and after a woman hath bred in it, it remaineth during the strength and ability of their age somewhat larger then when shee was a growne Maid, yet not about a handfull. In a woman with child it is increased into all dimensions, for the larger it is stretched the thicker it groweth, which is one of the wonders of Nature. It hath two sorts of parts, simple and compound. The simple parts are the Ligaments of which we haue spoken; membranes, veines, arteries and nerues, of all which the wombe is compounded. The compound parts are foure, the bottome, the mouth, the necke and the lap or outward priuity. The membranes are two, one outward another inward, whose Nature and property it is to be able to be extended or stretched, and againe contracted and gathered together. The *uter* [tab. 9. fig. 4. HH. tab. 5. OO. Q. Q.] which is called the common

The composition of the wombe. The similar parts of it. Membranes.

Table 11. the first Figure sheweth the wombe of a woman with childe opened in the length, that the after birth cleauing thereto might be scene. The 2. Figure sheweth the after birth separated from the wombe. The 3. Figure sheweth the coate wherein the vrine of the Infant is receiued. The 4. Figure sheweth the Allantoides and the Amnion opened, with the naturall scite of the Infant according to the common receiued opinion of Anatomists. The 5. Figure sheweth the coates or coverings of the Infant according to Vesalius, especially the membranous bladder which receiue the vrine of the Infant.

TAB. XI.

I. Figure.

A, B, C, D. The backe-part of the womb cut into foure parts.
E. A part of the necke of the wombe.
F, F. Veines and arteries compassing the neck of the wombe.
G. A certaine fleshy substance growing to the outward coate, calleth the cake of the Liuer of the womb, because of his manifold vessels. This ministreth blood vnto the Infant by the nauill.
HH. The outward covering of the Infant in the wombe which they call *Allantoides*.

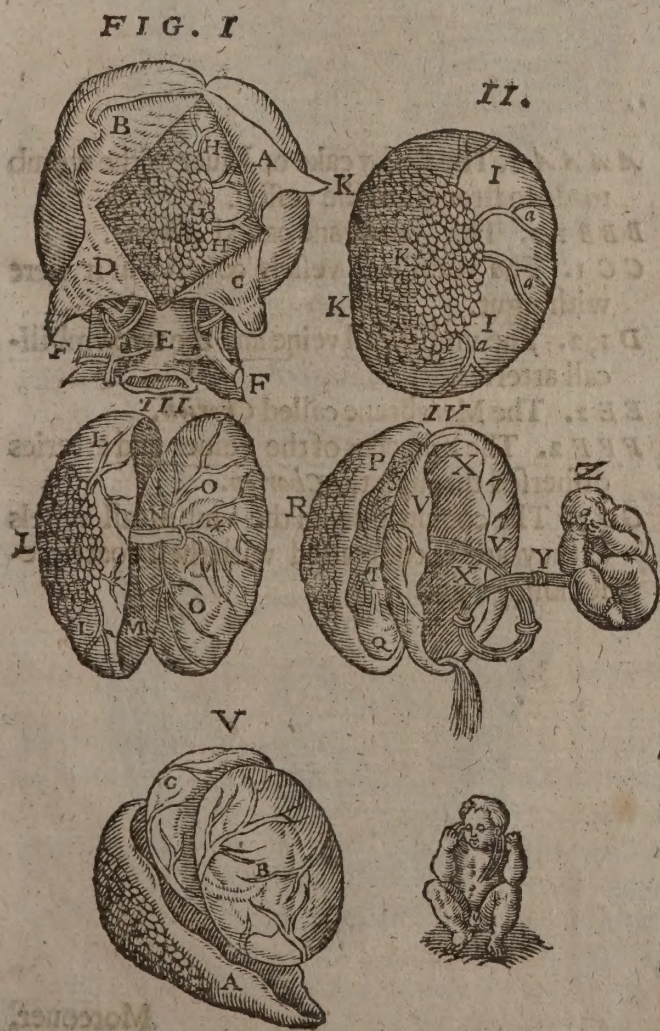
Figure 2, 3, 4.

aa. 2. The distribution of the vessels.
KK 2. The fleshy cake of the after-birth.
LLL 3. The outward coate of the Infant opened, to the backe side whereof cleaueth the afterbirth which some thinke is the *allantoides*.
M 3. The inside of this outward coat.
N 3. Vessels produced out of the cake or liuer of the womb, making the nauill of the Infant.
* The insertion of the vessels which make the nauill.
OO 3. The inner coate of the Infant yet whole, which they call *amnion*.
P 4. The outside of the *allantoides*.
Q 4. The inside of the same.
R 4. The cake, liuer, or after-birth.
ST 4. The vessels ioyning into one at T.
VV 4. The outside of the *amnion*.
XX 4. The inside of the same.
Y 4. The vmbilical vessels inserted into the nauill of the Infant.
Z 4. The Infant as it sitteth doubled in the wombe.

Figure 5.

A. The outward coate of the Infant cut length wise.
B. The inner coate or *amnion* yet whole.
C. A soft and thin Membrane like a bladder, leading out the vrine thorough the nauill; this keepeth the vrine of the Infant while it is in the wombe.

mem.



The duplicatio
of the inner
membrane.

What is the
substance of
the wombe.

How it in-
creaseth or de-
creaseth in
thicknes.

membrane and is nervous, is the thickest of all membranes that come from the *Pertionum*: wherefore it is strong and growes to the wombe on both sides and is doubled, inuesting it for more safety and strength. The inner [Table 9. Figure 4. EE, table 11. figure 1. ABCD,] or proper is double, but yet so ioyned that they can hardly be distinguished but in exulcerations; betweene which as betweene the coates of the stomacke there are placed fleshy fibres; which they that say the wombe hath but one coate, doe not call a coate but the very substance of the wombe, when indeed both these and the outward make the substance of it together membranous, thight, and compact; that when the burthen is increased they may be dilated, and after the birth may be contracted again; but by reason of this inner or proper membrane it is fleshy or very thick that it might haue heate to cherish the seed and the Infant; and beside it is porous, that it may bee extended according to the increasing of the burthen. Wherefore it exceedeth in thicknes all other coates of the belly, neyther doth it alwayes keepe the same thicknesse saith *Galen* in the 8. Chapter of his Booke *de dissectione uteri*: for in youth it is small and also the thinner, but after the courses begin it growes in thicknesse as in magnitude, as also it decreaseth both in magnitude and thicknesse when Women leaue to conceyue and their courses stay. For the beginning and end of their courses is, when they begin and cease to be fit for conception. So when the time of the courses is at hand, it growes thick & somewhat tumified, as being watered or dewed with the humidity of the blood which floweth vnto it. Againe, the oftner a woman hath conceived the thicker it is.

Table 12 wherein the after-birth together with the vmbilicall vessels are exhibited.

TABVLA XII.

FIG. I.

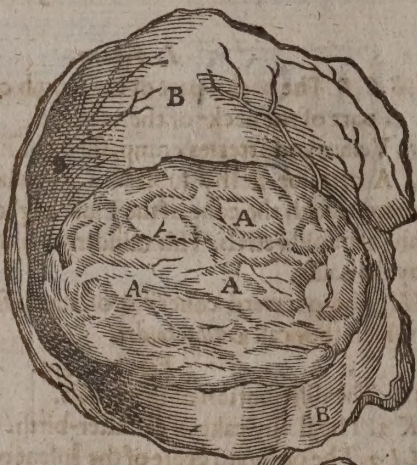


FIG. II.



- AAAA 1. The fleshy cake or Liuer of the womb made to strengthen the vessell.
 BBB 1, 2. The Membrane called *Ammios*.
 CC 1. The vmbilical vessels couered as it were with a gut.
 D 1, 2. The vmbilicall veine and the two vmbilicall arteries.
 EE 2. The Membrane called *Chorion*.
 FFF 2. The branches of the veines and arteries disperfed through the *Chorion*.
 GG 2. The coniunction of the vmbilicall vessels as they are encompassed with their coate, resembling a gut.

Moreover,

Moreover, in the time of conception it is thicke and softer and growes thicker as the conception encreaseth, being thickest of all at the time of the birth. Yet *Galen* leemeth to say otherwise in his Booke *de dissectione uteri*, and the 8. chapter, and the 14. booke of *the use of Parts*, and 14. chapter (which opinion of his many follow) albeit it is against himselfe a little before where he sayth, that it groweth thicke when the courses come because of blood; now we know that the greater the Infant growes, the more blood accrueth vnto the wombe.

And indeed by dissection we are taught, that about the time of deliuerance and in the last moneth it becommeth two fingers bredths thicke, and that not onely in one place but every where, especially toward the higher part of the bottome or soale in which the vessels of the wombe did meete, and to which the after-birth called the *secundina* doe adhere; for as wee said before after the conception it encreaseth in all kinds of dimensions till it be vnburdened. For from the plentiful confluence of blood, because of the many veins & arteries scatteringly disperfed through his coates, his substance becomes fleshy, fungous, spongy, and diuisible into many shels or huskes like a Bezoar stone, or after the manner of mushrummes that it might containe the greater quantity of blood and spirits for the life and nourishment of the Infant, and beside the heate beeing encreased it necessarily draweth more vnto it, and so it tumifieth and is distended; but after the birth when the confluence ceaseth, it returneth to his

Why women who haue conceived leaue bearing for a time, and after fall to it again.

TABVLA XIII.

FIG. I.



The first Figure sheweth an Infant of 14. daies old, in which all the parts are exactly delineated.

- A. The Infant.
- B B. The vmbilicall vessels meeting together.
- C C. The diuarcation of the vmbilicall Vessels, thorough the Chorion.
- D D D. The coate called Amnios.

FIG. II.



The second Figure sheweth an abortive Infant, which was anoyded the 25. day after conception, beeing deprived of blood to nourish it, because the vmbilicall vessels were broken. The magnitude of that Infant is perfectly described.

former

former both magnitude and thickeſſe. For if it neuer gathereth that carnoſity & ſoftneſſe the woman neuer conceiveth. But if it ſometimes do not gather it, then is ſhe for that time fruitleſſe, whence it is that we ſee ſome women which have conceived to become fruitleſſe for a ſpace, and after fall to bearing a freſh.

The Fibres of the wombe.

Comparison.

Archa.

The ſpermat- cal fibres of the wombe.

The veines & arteries of the wombe.

The veine from the ſpermat- ical.

Galen.

A cauſe of pleaſure.

The vein from the Hypogaſtrical.

Acetabula and Cotyledones what they are.

Betweene theſe Membranes run Fibres (ſaith *Galen* in his 14. Booke *De uſu partium*, and the 14. chapter) of all ſorts, becauſe it muſt draw and retaine the ſeede and expell the burthen; the fleſhy fibres make the proper *parenchyma* or fleſh of the wombe; that ſo the heate may be encreaſed for conception: by which alſo it may be, as by muſcles the voluntary motion of the wombe in drawing the ſeede into his cavity (as a Hart draweth a Snake out of the holes of the earth by drawing in his breath at his Noſethrills) and embracing it afterward is accompliſhed; haply alſo they have another uſe (ſayeth *Archangelus*) to thruſt out ſome recrements of the wombe, which cannot be cleaſed by the ſole compreſſion of the Muſcles of the *Abdomen*.

But in thoſe that are ſomewhat gone with childe, the trebble kinde of ſpermat- cal Fibres do appeare more manifeſtly, the right are inward which draw the ſeede, they are but few becauſe the ſeede is brought euen to the very mouth of the wombe by the yard. The oblique are in the middleſt and are moſt and moſt ſtrong, that they may retaine that which is conceiued till the due time; the tranſuerſe are outward very ſtrong alſo, becauſe of the force that is neceſſary in the deliuerance.

The veines and arteries which paſſe through the coates of the wombe are two fold, for two veines and two arteries are led thither from the ſpermat- cal [tab. 8. 11, tab. 9. fig. 1. H, fig. 2. ff, fig. 3. bb] veſſels, ſo many alſo from the Hypogaſtrical, which run vpward from below; [tab. 9. fig. 2. e, tab. 11. fig. 1. FF] that from all parts of the body as well below it as about it, blood might be miniſtered vnto it; for they bring not aliment onely to the wombe, but alſo to the Infant, as alſo they ſerue to empty the whole body in the menſtrual purgation. But the veines are greater then the arteries.

The one of theſe which proceedeth from the ſpermat- cal and deſcendeth from above, is diſſeminated through his whole bodie eſpecially through his bottome, to bring Aliment vnto it; yet the ends of the veſſels which are caried into the left ſide are vnited and become one with the ends of the veſſels which are diſtributed in his right ſide, that ſo the right ſide (for this is *Galen*'s opinion, in his 14. Booke *De uſu partium*, and the 9. Chapter) may take to it ſelfe ſome ſmall portion of whaeſy humiditie, which may by his acrimony ſtirre vp his action and procure pleaſure; as we ſee the whaeſy humors that are gathered vnder the ſkinne if they be heated, they ſtirre vp itching and a kinde of pleaſure withall. By this veine alſo the chiefe part of the menſtrual blood, eſpecially in women but not with childe, dooth flowe forth.

The other veine ariſeth from the Hypogaſtrical branch of the hollow veine at the ſides of the great bone about the ſhars; it is the greater and aſcendeth by the ſides of the necke vnto the middleſt of the wombe, where it mingleth it ſelfe with the former. This is diſtributed partly through the bottome of the wombe, partly through the necke of it. But the veſſels that paſſe through the bottome, are alwayes vnited (which ſaith *Fallopins*, Anatomists haue much neglected) by ſome branches, and that either without the wombe or in his ſubſtance: without the womb, the boughs of the vpper veine are ioyned with the ſmall branches of the lower at the necke of the wombe [tab. 9. fig. 2. e, with b] where on both ſides there are many veſſels, and theſe notable ones finger-fanged or placed like croſſe fingers, and being vnited doe paſſe into his ſubſtance and end or open into the cavity; which *Anaſtomoses* or inoculations of veines are more conſpicuous in women with childe, and thoſe whoſe courſes do flow or are neere vpon it. But if they be not vnited, then from the lower veine ſome branches are carried vpward, to be planted in the bottome.

The branches of this Hypogaſtrical veine being entred the ſubſtance of the wombe do mingle themſelues with the vpper branches proceeding from the ſpermat- cal, and the mouths or extremities of them reach vnto the inner cavity of it, and are called *Cotyledones* and *Acetabula*, to which in the conception the Liuer of the wombe or the after-birth doth cleaue, from whence the Infant receiueth aliment through the vmbilicall veſſels, and by which it is tied to the wombe. Through theſe, there arriueth more blood at the wombe then is neceſſary for the nourishment thereof all the while the Woman is chiding, that when conception ſhall happen to be, there may bee ſome quantiry of the Mothers blood at hand which is one of the principles of generation; as alſo that when the Infant is begotten and doth encrease, it may

may not want aliment according to that proportion it standeth in neede of; all which blond after the Infant is brought into the world, returneth back to the breasts and there is turned into milke.

At other times, because it is more plentiful then the wombe it selfe requireth, therefore it is like a superfluity excluded euery moneth, and if it bee retained it will corrupt and induceth many passions called *Hysterica*, which we call fits of the Mother, which yet are oftner procured by seed retheyned and corrupted then by blood. With this blood also other excrements contained in or amongst the blood and a whole heape of humors are purged sometimes in three dayes space, sometimes they flow longer, and commonly at the new moone the younger sort haue them, the elder in the full of the moone; which therefore we note, because when in Maidens the courses are stopped and they know not well when the time of their enacuation should be, we should apply our remedies either in the very end of the old Moone, or in the very beginning of the new.

Finally, the other part of the lower veine is inserted into the necke of the wombe, [tab. 9 fig. 2. e] whither if too much blood be brought by the spermatick vessels whilst the woman is with childe, it is exonerated not by the orifice or mouth of the wombe, but by the Anastomosis or inoculations of the veines into the necke of the same. Wherefore by these veines are some

The menstrual purgation.

An observation for the procuring of the courses.

The other parts of the Hypogastricall veines.

TABVLA XIII.

FIG.



The first Figure sheweth an Infant of 14. daies old, in which all the parts are exactly delineated.

- A. The Infant.
- BB. The vmbilicall vessels meeting together.
- CC. The diuarcation of the vmbilicall Vessels, thorough the Chorion.
- DD D. The coate called Amnios.

FIG. II.



The second Figure sheweth an abortive Infant, which was anoyed the 25. day after conception, beeing deprived of blood to nourish it, because the vmbilicall vessels were broken. The magnitude of that Infant is perfectly described.

X3

WOMEN

How and by
what waies
women with
childe have
their courfes.

Of the arterles
of the wombe.
Their vfe.

The nerues of
the wombe.

The caufe of
the confort be-
tweene the
wombe and
the head.
A caufe of
pleafure.

women with childe euacuated/ which haue plethoricall and full bodies and fo more affluence of blood in the firft months after their conception then is required for the nourifhment of the Infant,) and not by the bottome of the wombe as otherwife in maides and women the men- ftrual blood vseth to be purged; otherwife the Infant would be choaked with the aboundance of blood and the orifice of the wombe muft neceffarily be opened, which would bring a dan- ger of abortment.

That which wee haue fayed of the Veins wee muft fay of the Arteries which accompany them, whose vfe alfo is in thofe that be not with childe to encrease the heat of the wombe, to bring vnto it fpirit and vitall blood, together with vitall faculty and heat, and by their motion to ventilate or breath the in-bred heat, to fir the bloud and fo to preferue it from putrifaction. But whether in the time of the courfes the arteriall blood be alfo euacuated, we ingenuoufly confefle our felues to be ignorant, faith *Bauhine*, fure we are that from thefe forenamed veffels, or that which is called the lap or priuy veine, there are carried certaine fmall veines and arte- ries to the lap and the hillocks or caruncles thereof.

The nerues of the wombe though they be fmal, yet are they very many, implicated or cou- ched one within another like a net, that they may confer exquisite fence vnto it. To the higher part of the bottome of it, they come from the termination of the branches of the fixt coniuga- tion which paffe by the roots of the ribs. To the lower part of the bottome and to the necke, from the marrow of the loyns & the great bone, (whence is that admirable confort between the wombe and the head efpecially the backpart of it) that feeling thofe things that are trou- blefome, the expelling faculty might be prouoked, and pleafure alfo conceiued in coition, (therefore about the lower parts they are more plentiful) as alfo the motion of the wombe wherein it draweth and imbraceth the feed of the man quickned and strengthened. For there are certaine fleshy fibres in the wombe as we haue fheweth already, which are in fteed of fmal muscles. And thus far of the fimple and fimilar parts of the wombe or matrix, now followeth the compound or diffimilar.

CHAP. XIII.

Of the Compound or diffimilar parts of the wombe, and particularly
of the bottome and the orifice.

The parts of
the wombe.

The bottome
or foale.

The hornes.

Although from the bottome of the wombe to the very lap or priuities there be but one continuatd paffage, yet becaufe in it there are many and diuerfe parts, therefore it is diuided into the vpper part or the bottome, -the mouth or inward orifice of the necke, the necke it felfe and the outward priuity or lap. The bottome which is properly the wombe and the matrix, *Hippocrates* in his Book *de natura pueri* calleth *μήτηρ*, *sinus* the bofome. *Galen* fo alfo *lib. 14.* and *15. de vfu partium*, and the 3. chapters, and fometimes *μήτηρ*, that is, a ca- uity or hollownes. This is the chiefe of al the parts of it, becaufe for it all the other parts were made; for in it is the Infant conceiued of the feed, (that we may fo fay according to our manner of fpeech, though indeed conception is nothing els but the wombs receiuing and imbracing of the feede) formed and diftinguifhed, nourifhed and increafed, made a liuing foule and prefer- ued cuento the infufion of the foule that diuine and immortall fubftance, and then it thrufteth it into the fea of the world and the tides of the fame.

This bottome then is the vpper [*tab. 5. L. tab. 8. p. tab. 9. fig. 1. A. fig. 2. & 3. c*] fheweth the bottom of the wombe of a woman with childe cut open] and broader part of the wombe placed about the fhare bone, that fo it might better be dilated as the Infant increafeth; on the out fide fmoother, equal and lined ouer as it were with a waterifh moyfture; and fendeth out on either fide about a certaine production or rather a corner, which *Herophilus* compareth to the turning of a halfe moone; *Diocles* and with him *Galen* in *lib. 2. de diffectione vteri*, chap. 2. and chap. 8. and *lib. 14. of the vfe of parts* chap. 11. calleth them *νεφέλαι*, that is hornes, becaufe the fuperficies of the womb is there fomewhat more eminent, euen as in the heads of young calues there are certaine buds where the hornes will afterwards grow forth. Into thefe the feed of the woman is powred out in thofe that be not with child, for into them the leading veffels of feed are inserted. [*tab. 9. fig. 1. & fig. 2. gg. fig. 3. hh.*] Thefe you may plainly fee if you cut the bottom of the womb through the midft; for on the infide at the orifice [*tab. 9. fig. 4. G*] you fhall perceiue on each fide a little cornet [*tab. 9. fig. 4. at A & B*] which by degrees [*tab. 9. fig. 4. AB*] inlargeth it felfe toward the bottome.

The

The vse of these hornes is, that the wombe might bee made more capacious for the enter-
taining of the Infant, because vpon these two bales as vpon stocks may two vessels or Infants
be built or generated. Wherefore the wombe, because it is the instrument of conception hath
a cavity, and yet but one, for there are in it no partitions or chambers: notwithstanding it is
vsually diuided into the right and the left bosome; the right in which male children are con-
ceiued, the left in which females are conceiued, as *Hippocrates* and *Galen* haue determined:
yet is not this diuision made by any wall or partition, but onely by a line or suture and seame
[*tab. 9. fig. 4. C D*] lightly rising vp but very obscurely through the middle part of the superfi-
cies, and running forward and backward according to his longitude; which line or suture is
called by *Aristotle* in the 3. Booke of his History of Creatures and the first Chapter *Διὰ τὴν*
mediā or the middle: and thence it is that the Ancients doe not call it *matrix* but *ma-*
trices, or the mothers, as if there were two of them, and say they are answerable in number
to the breasts, for it is a very rare thing that a womans wombe should be diuided into two
as beasts are. This cavity [*table 9. figure 4. A B*] is smooth and so narrow that it will scarcely
hold a common beane, and when it receiue the feede from both the Parents it is filled with
it, for any portion of feede that getteth into it filleth it, because it embraceth it so narrowly;
for in the least portion of feede that may be, the whole formative faculty is potentially inclu-
ded, out of which mingled and as it were fermentated and houghed vp the Infant is generated,
and is encreased by blood estuons comming to it for nourishment, by which also the sub-
stance of the wombe groweth into a great bulke; as a little sponge if it bee filled with water
will arise to a greater magnitude, which being pressed out againe the sponge will become as
small as before.

The bottome hath many pores or passages which are the mouthes of the *Corolydones* so cal-
led, by which the blood in the time of gestation issueth out of the veines of the wombe into
his cavity. In women not pagled for the most part it is lined within with a viscous or slimy
substance, of colour betweene a pale yellow and a red. The substance of the bottome of the
wombe is harder and more compact then that of the lap, yet softer then that of the necke, and
in the corners it is rugous.

From the lower part of the bottome there runneth a notable particle or portion of it resem-
bling the nut of the yarde [*tab. 9. fig. 1. C D*] which with his blunt head toucheth not the sides of
the necke; about an inch long it is, but as slender as a little finger, that it will scarcely admit a
Probe or a small penne at the most: but it is rough least the feede that is drawne should fall
backe, which commeth to passe in those women who haue this part slippery because their hu-
mors are faulty, & so become barren. This part which is betweene the beginning of the bot-
tome and the orifice, *Falopius* thinks was called the neck by *Galen*, *Soranus*, and the ancients. It
hath a manifest passage [*tab. 9. fig. 1. betweene C & D*] which maketh also another compound
part of the wombe.

This passage is the entrance into the bottome of the wombe, wherefore *Hippocrates* in the 1.
section of his Aphorismes, & the 51. Aphorisme calleth it *ὁμα τῶν ὀστέων, ἢ τῶν μὲν τῶν, ὡς ὕπερ*
the mouth of the wombe: *Galen* in his 14. Book *de usu partium* and the 3. Chapter, and in the
7. Chapter of his Booke *de dissectione uteri*, calleth it the inward orifice of the necke, for by
this the bottome openeth directly into the necke. This orifice is transuerse or outward like a
Plaice mouth, or most like to the passage in the nutte of the yarde: so that the whole orifice
with the transuerse slitte, is like the letter, *e*, small and wondrous narrow, that the feede once
receiued cannot easily fall backe, nor any thing hurtfull get into the cauitie of the wombe.
It is direct against the bottome, because the mans feede might passe in a right line through the
necke and it to the bottome; and so also it might be better drawne by the bottome, from
a leuell, for if it bee diuerred or turned aside many euils follow sayeth *Hippocrates* in his first
Booke of the diseases of Women, for then the wombe receiue the feede, but it falleth
backe againe out of the necke instantly. Then also the courses either come not at all, or with
great violence and disease: it is alwayes shut except onely at that time, when in coition the
bottome draweth the mans seed, and when the seed is conceiued or receiued then is it so clo-
sely shut vp sayeth *Hippocrates* in the 51. Aphorisme of the 5. Section, that a Needle or a small
Probe can hardly be thrust into it: and so it continues 9. months; for when women with child
yeelde seed it is not out of the bottome but by the necke of the wombe, as we haue sayd be-
fore.

Very rarely is it opened, and that either for the casting out of a false conception though
sometime a perfect conception remaineth behinde, or in superfetation where after one
conception

Their vse.

The cavity of
the wombe.The suture of
line.The least quan-
tity of seed fil-
leth the
wombe.A fit compa-
rison.The way of
the blood for
the nourishment
of the Infant.A secret part
wanting a
name.*Falopius* his
conceit of the
name of it.The orifice or
mouth of the
wombe.The fashion
of it.The closenes
of it.By how many
meanes it is o-
pened.

Note this.

The admirable
worke of God
in the birth.The crowne
or rose of the
wombe.
Why Harlots
donot conceiue.

conception another is admitted. So likewise, when the wombe (not fit to conceiue) doth belch out againe the seed of both parties; or when as in pollutions or affections women that haue not conceiued do loose their owne seed; or when as in women vnburdened the courses or any offensiues humors are that way purged, as in the Whites, in which case oftentimes the whole body is purged that way, the womb at all not being affected; or when false conceptions alone are cast out, as the *Mola* or Moone-calse, and such like; or finally, when the Infant it selfe is borne into the world; for when that is perfected, this passage is so distended and openeth so wide, that from the bottome of the wombe to the very lap the cavity is equall, that through it the Infant may passe; which admirable worke of Nature, or Natures Maister God himselfe, we may wonder at, but not vnderstand saith *Galen* in his 15. book *de vfu partium*, & the 17. chapter.

But because it must be opened according to the magnitude of the Infant, & that by degrees (being of a thicke and fast substance [tab. 9. fig. 4. at G] and is yet thicker when the birth approacheth,) there cleaueth vnto it a certain viscid and slimy body like glew, that by the helpe of it, the orifice without feare of dilaceration or diuision may be distended and naturally opened. This is round like a crowne, and as often as the passage openeth, commeth away in an orbicular forme. The Midwiues call it the Crowne or the Rose. This Orifice, if it be too much loosened or opened aboue measure, as in ouer-moyst bodies, or in the Whites, or by reason of too frequent copulation as in Harlots, it bringeth barrennesse; so doth it also if it be too fat, or thick, or grow callous or hard; sometimes there grow in it the Scirrhus or the Cancer both incurable diseases, which happen especially when the Courses faile.

CHAP. XV.

Of the necke of the wombe and of the Hymen.

The necke of
the wombe.
14. vfu part. 3.
15. vfu part. 3.
14. vfu part. 4.
lib. 7. hist. 1.

He third part of the wombe is the neck called *Cervix* or *Collum vteri* [tab. 9. fig. 2. and 3. d, fig. 4. KK, in the first figure the necke is turned upward at BB] into which the yard passeth. This *Galen* commonly calleth *αὐχὴν τῆς μήτρας*, sometime *ῥαχιδος* and *σώμαχος*. *Aristotle* *μήτρα, καυλὸς καὶ σῶμα τῆς ὑέρας*, the matrix, the neck, & the gate of the wombe. It is a passage within the Cavity of the *Peritoneum*, called the *Bason* or *Lauer*, placed betweene the right gut and the bladder, whiter then the superficies of the bottome. It hath a deepe cavity and wide, (whence *Falopius* calleth it *the bosome of modesty*) but the mouth or entrance of it is much narrower. It reacheth from the inner [tab. 5. fig. 4. G] orifice of the womb, to the outward orifice [tab. 9. fig. 4. O] or very lap and priuity, and being long that the seede of the man may be brought to the orifice of the wombe it receiue the yard fitly like a sheath, wherefore the amplitude is answerable to that it must containe and is not broader then the right gut. It becommeth in the time of coition longer or shorter, wider or narrower as the yard is; and according to the womans appetite more or lesse turgid, more open or more contracted and direct; wherefore the length of it cannot belimited no more then the length of the yarde; and though it be continued with the bottome, yet it hath a diuers substance from it. For it is Membranous and Neruous, that it may better be enlarged or contracted, neither too hard, nor too soft.

The substance.

The straight-
nesse whence
caused.The folds of
it.

The substance of it, is somewhat fungous or spongy, like that of a mans yarde, for as it was necessary that the yard should be distended to fill this, so it was necessary that this in coition should be so contracted & straightened that it might straightly embrace the same, which happens by reason of many small Arteries which fill the passage with spirits, and so it becommeth narrower. Wherefore in women that are full of lust, or in the time of any womans appetite it strutteth and the Caruncles swell outward (which in Cowes and Bitches is so apparent, that their priuities seeme to be very much enflamed) and the cavity growes very straight. In yong wenches it is more delicate and soft, & becommeth every day harder, so that those that haue often conceiued and old women, haue it hard callous and as it were gristly, by reason of the often attrition and the frequent flowing of their courses. Whereupon *Herophylus* compared it to the weazon or winde-pipe. This when it is not distended is rugous, if it be much stretched it becommeth smooth and slippery, vnlesse it be in that part which endeth in the lap, but in the entrance of the passage and in the fore part, there are many round folds for the greater pleasure of louers which commeth from the attrition of them by the nut of the yard. These folds are in yong women smoother and narrower, and the passage straighter, that it wil scarce admit a finger,

ger, which is not from the closing of the sides of his necke, but by reason of the mediocrity of his passage, yet thorough it do passe not onely the blood in the monthly euacuations of grown Maidens, but also other corrupt humors in the disease of the whites or womens fluxe, which also we haue scene (being taught by *Aristotle* to obserue it) to bee purged this way in young children of foure or five yeere old.

A strange obseruation.

The attrition of these folds and their extension in the first society of maids with men, *Soranus* thought to be the cause of some maydens paine in deuirgination or losse of their maidenhead as we speak, & because certaine veines passe by them these being broken by the husband the blood issueth sometimes in great aboundance: but the neck (when neither the seed is sent in, nor the Infant is excluded, but at other times) is writhen and oblique, for being loosned and falling into it selfe, it is necessary that it must haue certaine contorsions or wrethings, that the parts within contained may be defended from outward cold, wherefore then it is shorter and narrower, but in coition it is distended vnto the measure of the yarde, in the birth to the measure of the Infant which is to passe through it: and therefore when the courses flow, but especially when the time of deliuerance is at hand, the neck becoming right, straight and open, women are most subiect to take cold by it.

The cause of paine in deuirgination of a Maid.

When women take most cold

In the end of this neck, immediately aboue the necke [*tab. 9. fig. 2. m, fig. 3. e, fig. 4. L*] of the bladder, they place in Virgins the *Hymen* or *Eugion*, [*tab. 9. fig. 4. n*] which many will haue to be a slender Membrane, neruous, not thicke, placed ouerthwart that it may shut the cavity of the necke of the wombe, yet perforated in the midst like a ring, that in growne maids it will admit the top of a little finger, that through it the courses may passe sprinkled also with veines. This they say is broken in the deuirgination, from whence comes the paine & effusion of blood, and after it vanisheth as doth the bridle of the nut of a mans yarde: with this also are the wings or lips of the lap tyed together, because there is no vse of a large entrance before coition.

The Hymen.

But let vs set downe with your patience, the true History of the *Hymen*, which *Senerimus Pinus* the French Kings Chyrurgion hath diligently and at large recorded.

A discourse of the Hymen out of *Pinus*.

In the middle of the trench which is in the great slit or clift lyeth alwayes hid the orifice of the Maidens bosome of modesty, being placed not in the end of the trench, but in the inner end of that production which is annexed to the trench. This production which is peculiar to Virgins, is as long as the little finger is broad in the midst, & is incircled aboue with a round cavity. The figure of it is round, yet determineth into a sharpnes, and in the end hath one notable passage which will admit the top of the little finger.

The substance is partly fleshy partly membranous, being compounded of Caruncles or little peeces of flesh and membranes. The Caruncles are foure, and are like the berries of the Mirtle, in euery corner of the bosome one; the membranes tying them together are also foure, which are not disposed ouerthwart but runne all right downward from the inner end of the sayed bosome, and are placed each in the distances betweene euery Caruncle, with which they are almost equally extended or stretched forth. But these both Caruncles and Membranes are in some bodies shorter or longer, thicker or thinner then in others, as also the orifice at the end of them is in some wider in some narrower, and then especially is at the straightest when the Caruncles and the fleshy Membranes are neerest ioyned together, from whence comes either greater or lesse payne in deuirgination or deflowering, which *Terence* calleth *The sharpe coition*.

The caruncles.

Whence cometh the paine in deuirgination.

All these particles together make the forme of the cup of a little rose halfe blowne when the bearded leaues are taken away. Or this production with the lappe or priuity may be likened to the great Cloue Gilly-flower when it is moderately blowne. *Galen* in the second Chapter of his Booke *De uteri dissectione* likeneth this production to the prepuce or foreskin of a man, because it is somewhat long and perforated in the end; yet is it a little more fleshy and softer then the fore skin. It is called *Hymen quasi Limen*, as it were the entrance, the pillar, or locke, or flower of Virginitie. For being whole it is the onely sure note of vnsteynd Virginitie (yet some also haue other quaint deuices to try Virginitie with; as if a third measured from the tip of the nose along the fore head to the end of the sagittal future or seame, will also fitly encompassse the Womans necke,) for when the yarde entreteth into the necke of the wombe, when the fleshy Membranes which are among the Caruncles, are torne vp euen to their rootes, and the Caruncles are so fretted and stretched, that a Man would beleue they were neuer ioyned; some notable vessels are opened, and in the breaking is payne, which in young wenchies is more because of the drynesse of the part, but the effusion

Hymen.

An old trick to try a mayd.

The true cause of paine in deuirgination.

why some haue
no paine in de-
uiration.

A good caueat
for Mothers
concernin
their daugh-
ters honor.

The caruncles.
Their situati-
on.
Their vse.

The outward
orifice of the
necke.

The diseases
of it.

Historie out
of *Rubine*.

The skinny
ligament.

A pretty obser-
uation concer-
ning this liga-
ment.

on of blood the lesse, because of the smalnesse of the vessels. In elder maids whose courses haue now some good time flowed, there is lesse paine, because of the moysture and laxitie of the Hymen; but the effusion of blood is greater because the vessels are grown larger and the blood gotten a fuller course vnto them. For all virgins although they be neuer so mellow, yet haue their first coition painfull, but some more some lesse; vnlesse they then are menstruous, or haue beene within three or foure dayes, for then they admit the yard with lesse trouble, because of the relaxation and lubricity of these moist parts whereupon the Membranes are dilated with little or no paine. And this hath beene the cause why some men haue vnworthily suspected the vncorrupted chastity of their wiues. Wherefore it were fit the mothers or women friends of such virgins should haue care of their honor, by giuing warning to their Bridegroomes of their brides purgations, if at that timethey bee vpon them; and very often they are when the Brides are growne women and well complexioned, because the ioy and priuate pleasures of affianced young folkes, as also their dancings and frolike diet with such like, do often by moouing the body accelerate and hasten such purgations, and being come do cause them longer to endure.

The torne Membranes of this production in their vtmost compasse indented, do sometimes hang downe on either hand in the sides by the cleft like vnto valves (for so *Pinam* calleth the) or leafe-gates, which are much lesse then the *Nympha*, but of the same figure and vse. These are not lost, before a woman hath borne a childe, but are reserued being returned vpward to the orifice of the necke of the wombe, now made much wider then in the time of virginity: but in those that haue often brought forth large limb'd Infants, or whose wombe hath falne downward and so the necke of it beeing inuerted or turned, they are lesned and contracted or drawne vpward toward the necke and so perfectly vnited to the caruncles to which they adhere, that they seeme to be vtterly perished.

But the foure Caruncles which are like Mirtle berries, whereof one and the foremost is placed at the orifice of the bladder, another and the hindmost with the two laterall situated not ouer-thwart but length-wise; these I say doe remaine as long as the woman liueth, though she liue very long. Their vse, as also that of the Membranes when they are reflected vpward, is immediately to stop the orifice of the necke of the wombe as a fleshy production doth stop the necke of the bladder; they hinder also the ingresse of cold aire, dust, or any other such like (in which seruice they are assisted also by the *Nympha*, and the wings of the lap or priuity) and in coition doe aggrate the member of the man; for when they are heated and grow turgid with spirits, they so constringe the yard especially in yong women, as if it were closely pressed in the hand.

Next to these is the rugous or plighted chinke or riste, which is placed as it were in the trench of the great Cleft, and like a narrow valley leadeth the way by a round cavity into the inward parts, and maketh the outward orifice of the neck. *Galen* in his 15. book *de usu partium*, and the 3. chapter, calleth it *σώμα τραχήλου*, or the outward orifice of the necke of the wombe, by which the yard is receiued to prouoke the parts of the woman to yeelde their seede, and to infuse his owne. This orifice sometimes by a disease called *Rhagades*, otherwhile by a great cicatrice or scar bred after some other exulceration, is so streightned, that such women can no more admit their husbands; sometimes through a notable exulceration after a hard trauell it groweth cleane vp, which once we obserued (saith *Banrhine*) in an honorable Matron in whom appeared not any signe of an entrance, but after a whole yeere keeping her owne counsell her courses being all that while stopped, she was tormented with many convulsive fittes of the mother, and so perished through her owne default.

Heere is also to be obserued a skinny Ligament in the backe part of the outward Orifice of the necke, which in virgins is straighter and is couered by the trench, but in those that haue brought forth it is much more lax & loose, so that the loosenesse of this Ligament or skinny rye is the only signe that a woman hath borne a childe; for it is so alwayes in such and in none but such, vnlesse in others the wombe do, or haue falne downe; to this signe there happeneth sometimes another, and that is the ruggednesse or small plights of the skiane of the lower belly, which being strained in trauell remaineth euer after rugous.

CHAP. XVI.

Of the Lap or Priuitie.



The last dissimilar part of the womb, *Galen* in his 14. and 15. Books *de vsu partium*, the 6. and the 3. chapters, calleth *αἰδορ γυναικείον*, in Latine *pudendum muliebre*, that is, the womans modesty, [*tab. 9. fig. 2. l. fig. 4. neere n. o.*] of some *Vulva*, as it were *vallis* a valley, or *Valva* a Flood-gate, because it is diuided into two parts by a cleft, which like Flood-gates or leafe-doores are easily opened or shut as neede is. We will call it the lappe. It is that part into which the necke of the womb determineth, and is seated outwardly at the forepart of the share bone, and is as it were a skinny addition of the neck, as *Galen* speaketh in his 14. Booke *de vsu partium*, and the 6. Chapter, answering to the prepuce or foreskin of a man. In this there are many parts to be discerned without dissection. Of which some are altogether outward, offering themselues before the wings be displaid; others inward, not appearing before the wings be opened and separated on both sides. Of which we will first entreate.

There is therefore a large trench, in which are the passage of the neck [*tab. 9. fig. 2. m. fig. 3. e. fig. 4. l.*] of the bladder with a Caruncle, the *Nympha* and the *Clitoris*. For, although the Hymen and his membranes and caruncles with the flitte and the orifice of the necke may also be seene without dissection, yet because they pertaine not to the lap but to the neck of the wombe, we haue described them already.

At the end therefore of the necke of the womb, immediately vnder the share-bone, lightly above the lap it selfe, on the fore-part there is an entrance or passage which commeth out of the implantation of the neck of the bladder, by which the vrine is let out into the utmost part of the neck of the wombe, or rather into the lap it selfe, euen as in a man the vrine floweth out of the passage or channell which is appointed for the seede. In the compasse of this there is a caruncle [*tab. 9. fig. 4. p.*] or a little fleshy hillocke by which this passage is couered, that after the vrine is let go, the outward aire should not get into the bladder through his necke which is short and wide; which caruncle also as it regardeth the trench, strengtheneth the leafe-gate or locke of virginity.

The *Nympha*, so called by *Galen*, of others *αἰδορ γυναικείον*, because they first admit the man, of the Latines *Ala* the wings, of others skinny caruncles, are two productions on either side one, in the beginning almost ioyned; which arise from a welt or gard of the skin of the substance of a Ligament in the backe part of the orifice of the neck, and lying hid between the two lips of the lap and almost alwayes touching one another, do ascend to the end of the commissure or meeting of the share-bones. These being ioyned doe make a fleshy eminence, and couering the *Clitoris* with a fore-skin ascend with a manifest rising Line to the top of the great cleft: they are longer from their middle outward and do hang sometimes a little foorth through the great cleft, without the lips of the lap, & that with a blunt angle, being otherwise of a triangular figure.

They are very like in colour and shape to that part of a Cockes combe which hangs vnder his throate. Their substance is partly fleshy, partly membranous, soft & fungous, & they are inuested with a thin coate. Sometimes, they grow to a great length on one side, more rarely on both; and not so ordinarily in maidens as in women, (and then it is called by *Ruffus* *κέρκωσις*) what through the affluence of humors, what through attrectation, that for the trouble and shame (being in many Countreies a notable argument of petulancy and immodesty) they neede the Chirurgions helpe to cut them off (although they bleed much and are hardly cicatrised) especially among the Egyptians, amongst whom this accident (as *Galen* saith) is very familiar. Wherefore in Maidens before they grow too long they cut them off, and before they marry.

These *Nymphae*, beside the great pleasures women haue by them in coition, doe also defend the wombe from outward iniuries, being of that vse to the orifice of the necke which the fore-skin is to the yard; for they do not onely shut the cleft as it were with lips, but also immediately defend the orifice as well of the bladder as the wombe from colde aire and other hurtfull things. Moreouer, they leade the vrine through a long passage as it were betweene two walles, receiuing it from the bottome of the cleft as out of a Tunnell: from whence it is that it runneth foorth in a broad streame with a hissing noyse, not wetting the wings

The names of the lap.

The position of it.

The parts of it.

The inner parts of the Lap.

The passage of the vrine.

The caruncle belonging to it.

The *Nymphae*.

Their situation.

Their substance.

The Egyptian women lasciuious.

Their uses.

Why they are called *Nymphae*.

wings of the lap in the passage; & from these vses they haue their name of *Nymphes*, because they ioine into the passage of the vrine, and the necke of the womb; out of which, as out of Fountaines (and the *Nymphes* are sayed to bee presidents or Dieties of the Fountaines) water and humors doe issue: and beside, because in them are the venereal delicacies, for the Poets say that the *Nymphes* lasciuiously seeke out the *Satyres* among the Woods and Forrests.

How it differeth from a mans.

Their substances.

The originall of it.

Tribades or *sodoma*
Leo Africanus,
Celsus, *Aurelianus*
The vse of it.

The wise disposition of nature.

The outward parts of the lip.

Oris the great fissure.

Clitoris in Greeke *κλειτορις* commeth of an obscene word signifying contumeliation, but properly it is called the womans yard. It is a small production in the vpper, forward [tab. 9. fig. 4. m.] & middle fatty part of the share, in the top of the greater cleft where the *Nymphes* doe meet, and is answerable to the member of the man, from which it differs in the length, the common passage and the want of one paire of muscles; but agrees in scituation, substance and composition. For it consisteth of two neruous bodies (which *Laurentius* calls ligaments) round, without hard and thick, but within spongy and porous, that when the spirits come into it, it may be distended and grow loose when they are dissipated; these bodies, as those of the mans yarde, are full of black, thick and sprightfull blood.

Their originall is from both the share-bones where they ioine with the bone of the hip & are seuered at first, but after they are gone a little foreward they are vnited about the coniunction of the share-bones, and so make the body of a yard hard and solide, and haue a termination like the nut, to which on either side is adioyned a small muscle.

The head is properly called *Tentigo* by *Iuuenal*, which is couered with a fine skin made of the coniunction of the *Nympha* as it were with a fore-skin. It hath an entrace but no through passage; there are vessels also running along the back of it as in a mans yarde; and although for the most part it hath but a small production hidden vnder the *Nymphes* and hard to be felt with curiosity, yet sometimes it groweth to such a length that it hangeth without the cleft like a mans member; especially when it is fretted with the touch of the cloaths, and so strutteth and groweth to a rigidity as doth the yarde of a man. And this part it is which those wicked women doe abuse called *Tribades* (often mentioned by many authors, and in some states worthily punished) to their mutuall and vnaturall lustes.

The vse of this part is the same with the bridle of the yard; for because the testicles of the women are far distant from the yard of the man, the imagination is carried to the spermatieall vessels by the motion and attrition of this *Clitoris*, together with the lower ligatures of the wombe, whose originall toucheth, cleaueth and is tyed to the leading vessels of the seede, and so the profusion of their seede is stirred vp for generation, for which businesse it was not necessary it should be large: wherefore although by this passage their seede is not eiaculated, yet by the attrition of it their imagination is wrought to call that out that lyeth deeply hidden in the body, and hence it is called *æstrum Veneris* & *dulcedo Amoris*; for in it with the ligaments inserted into it, is the especiall seate of delight in their venereall imbracements, as *Columbus* imagineth he first discovered.

For Nature, who wisheth as *Galen* saith in his 14. book *de vsu partium*, and the 2. chap. that if it might be, her work might be immortall, and falling from that hope because of the contrariety of the matter, hath giuen to all creatures both the instruments of conception, and hath also infused into them a strange and violent kind of delight, that none of the kindes of creatures should perish but remaine euer after a sort immortall. And truly it was very necessary that there should be a kinde of pleasant force or violence in the Nature of mankind to transport him out of himselfe or beside himselfe as it were, in the act of generation; to which otherwise being master of himselfe he would hardly haue beene drawne: which extasie, (for it is called a little *Epilepsie* or falling sicknes) is caused by the touch of the seed vpon the neruous and quicke sensed parts as it passeth by them.

To draw to an end. Those parts which appeare outwardly are the great slit, the lips and the groyne or leske: for as soon as the lippes are diuided, there appeare three clefts or slits; one and the greatest which is the first and vtmost, and two lesser and collaterall betweene the *Nymphes*, the vse of which is to close vp the parts more safely. But that cleft which is called *orisma* or the great and long fissure is made by the lips and bendeth backward to the Fundament from the share-bones downward toward the cleft of the buttocks: for it ought to bee longer then the orifice, least the Infant should bee hindered in the birth, because the skinne is much thicker and not so yeelding as are Membranes: and the more it tendeth backward the deeper and broader it is, and so degenerateth into a trench or valley, representing the figure of a boate, and endeth in the welt of the orifice of the necke. In the middle

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The bottome all
fig. 2. c. that reach
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die of his trench is placed the orifice of the necke, and this is the fissure that admitteth the yard, and is a part thought too obscene to looke vpon; which is the reason sayth *Pliny* that the carcasses of women doe floate in the water with their faces downward, contrary to mens which swimme vpwrd; euen Nature it selfe yeelding to modesty; although the cause also may be referred to the largenes of a womans belly, as also because the water getting into the lap filleth the belly, & for that the waight of her breasts turneth her body downwards.

The two lips which *Hippocrates* in his Booke *de locis in homine* calleth *neplava*, folow next, which make the fissure of the outward orifice; they are long, soft and of a skinny substance and fleshy withall, after a sort glandulous and spongy, and vnder them haue a hard fat and are as it were callous. They are couered with a thin skinne, and are in married women more smooth and depressed.

The extuberations of these winges are called hillocks or mountaints (*Vesalius* calleth these extuberations *ala* or wings, the other *labra* or lippes) and the mount of *Venus*: these in mature or ripe women are adorned with haire, the bush of which is called *pubes* or *pecten*. These hayres are in women more curled then in Virgins, & do reach as a covering vnto the lippes; the lippes were made for ornament and for defence that the wombe might be kept from refrigeration.

But if in the demonstration of the wombe we will begin at the externall parts, wee must proceede by the guide of a vterine probe, and then the partes will thus arise. First the region of the share-bones, then the bush, the hillocks whereon the hayre growes, the two lips, the great outward fissure betweene the lippes making the outward orifice, the trench like a boate, the two smaller clefts or fissures between the Nymphes, the two Nymphes themselves; the *Tentigo* or head or nutte of the *Clitoris* covered by the Nymphes as by a foreskin and the impassable passage of it; the two bodies of the *Clitoris* and two muscles belonging to it; the passage of the necke of the bladder with the Caruncle or fleshy hillocke which couers it; the skinny ligament which wee sayd was a signe whether a woman had beene a mother or no; the rugous fissure or cleft making the orifice of the necke; the foure Caruncles and the foure membranes between them making the *Hymen* in virgins, the necke or canale of the wombe, all these may be seene without incision, the rest must be found by incision.

And thus much of the parts of generation belonging to women; now the discourse of Hermaphrodites or of *Androgynes* that are both man and woman, wee will referre to another place.

CHAP. XVII.

Of the wombe of a Sheepe and a Dogge.

Now because in the want of womens bodies it is an ordinary custome for Anatomists to exercise themselves and their auditors in the dissection of the wombes of other creatures; therefore I will shortly exhibite vnto you the wombe of an Ewe and a Bitch, as well by way of history as also by a Table carued onely for that purpose.

In an Ewe therefore the necke of the wombe reacheth from the priuity to the top of the Holy-bone, where beginneth the bottome of the wombe spreading it selfe a litle in the region of the Loynes. This wombe is a long body pressed on either side, but toward the end it parteth into two processses looking vpwrd and bending outward very like the hornes of a Ramme. [table 14. figure 2, E] The outward superficies of the bottome, after the manner of membranes is glib and smooth and is tyed to the neighbour parts (euen as the necke is tyed) by membranous ligaments arising from the *Peritoneum*, through which there are also vessels disseminated which are sent vnto the wombe. The processses of the bottome where they are diuided asunder on the insides are also smooth, and doe growe to many particules of the belly, but their outsides are continued with the bottome of the wombe it selfe by certaine membranes.

The bottome also hath two cauities [tab. 14. fig. 2. D] which meete at his orifice [tab. 14. fig. 2. C] that reacheth vnto the necke. The cauities or bosomes are somewhat yellowish, and haue in them many risings or swellings like little knobbes, which after the creature hath conceived, open themselves and make dennes or cauities. If they breed one Lambe, then

The reasons why the carcasses of women floate with their faces downwards

The lips.

Mont Veneris the mountaine of Venus Pubes, pecten or the bush. Their use.

Another way of demonstration of the parts and appurtenances of the wombe.

Why we haue added this cha.

The wombe of an Ewe or a Cow. The Figure.

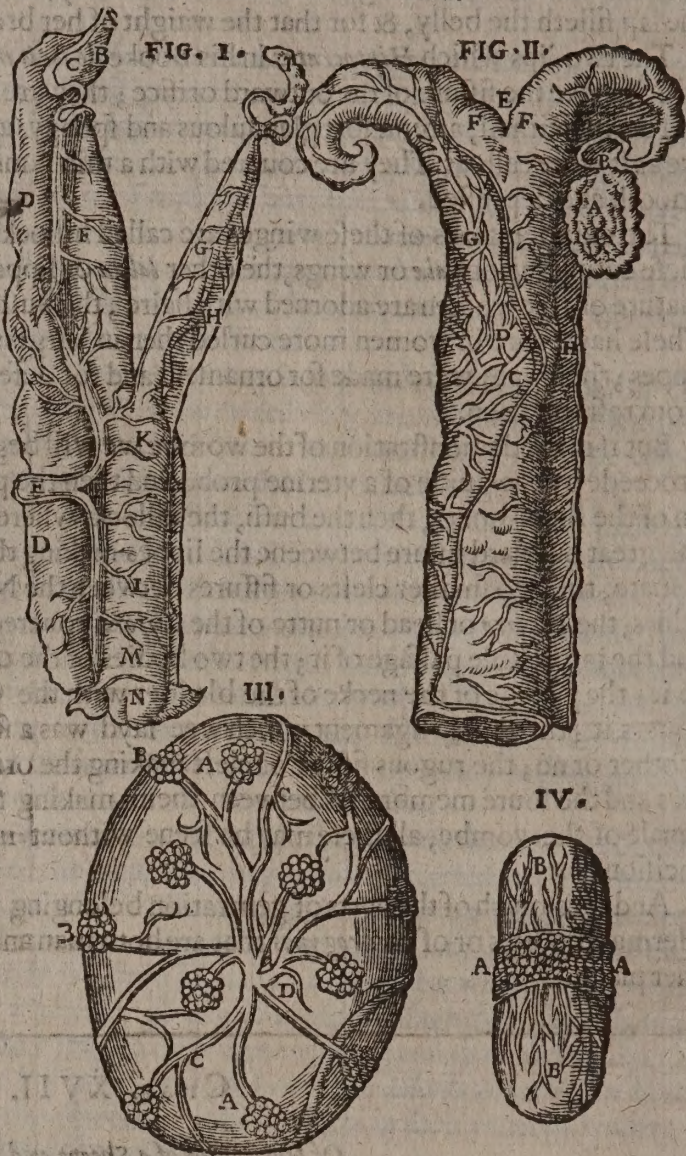
Connexion

The bottome

The first figure sheweth the wombe of a dog, because those may more plentifully be gotten for dissection. The second figure sheweth the wombe of a Cow (altogether like that of a Sheepe, saving that it is bigger, that the horns might better appeare, because it is fit that young Anatomistes should exercise themselves in the dissection of the wombes of sheepe. The third sheweth the after birth or cleansing of a Cow. The fourth hath another representation of the cleansing of a Cow.

TABVLA XIII.

- I. Figure.*
A. The spermaticall Veine and artery.
B. Portions of the spermaticall vessels reaching branches to the upper part of the wombe.
C. The Testicle and the Leading vessel.
D D. A Membrane tying the womb to the Peritonaeum.
E. A veine and artery distributed to the necke of the wombe, and the lower part of the bottome.
F. The right side of the bottome of the wombe, covered with the outward coat.
G. The left side of the bottome of the wombe halfe of it freed from the outward coat.
H. The outward covering at G, the inward H.
I. The left leading vessel separated from the testicle.
K. The place where is the orifice of the bottome of the womb.
L. The necke of the womb, the left side is vncouered from the outward coat.
M. A part of the necke of the bladder.
N. The skin left at the primity.
- II. Figure.*
A. The left testicle.
B. The vessel leading the seeds into the hornes of the wombe.
C. The place of the orifice of the bottome of the wombe.
D. The places where the wombe is divided into two parts.
E. The two parts of the womb resembling the hornes of a Ram.
F, G. The outward coats of the wombe at F, the inner at G.
H. A portion of a Membrane, ioyning the womb to the Peritonaeum.
- III. Figure.*
A A. The outward covering of the Calfe.
B B. The places where the outward covering is tied to the womb and admitterh the vessels, where also there is a fleshy substance, which is likened to the flesh of the Splene.
C C. The meeting of the veines and arteries through this covering, for the making of the vmbilicall vessels.
D. The place where those veines and arteries disperfed through this covering, are gathered together a little before they make the vmbilicall vessels.
- IV. Figure.*
A A. A fleshy substance growing vpon the outside of the vter covering of the Calfe, which compasseth the covering ouerthwart, otherwise then in men.
B B. That part of the outward covering which is not ouer growne with that fleshy substance marked with A A. but is branched with veines and arteries.



then onely one of the cavities is dilated; if two, then in each cavity is one containd. The membranes of this wombe are two, one externall [tab. 14. fig. 2, F F] from the Peritonaeum, from which the Ligaments no proceede, and wherein the vessels are ledde vnto the womb. The other internall [tab. 14. fig. 2, G] and proper, which compasseth the womb round about. Between these coates are disperfed an infinite number of veines & Arteries, strangely implicated or folded together; and these implications are heere more manifest by much then they are in the womb of a woman, although the coates of her womb be rent asunder. About these vessels there appeare many round bodies like little knubs, which in women are called *Acetabula*, [tab. 9. fig. 4, about E and D] very small they are, and nothing else but the mouths of the vessels.

The Testicles. Their Testicles are situated at the sides of the wombe [tab. 14. fig. 2, A] vnder the tops of the hornes. The vessels which attaine vnto the Testicles and the wombe are the very same with those of a woman both in their originall and their passage, excepting those which leade the seede into the cavity of the womb, whose implantation in these creatures is much more manifest, so that you may easily enter a Probe into them. Such also and after the same manner is the fashion of the wombes of a Goate and of a Cow.

The womb of a Bitch. But the womb of a Bitch, [tab. 14. fig. 1] hath a neck [tab. 14. fig. 1, L] reaching but to the beginning of the Holy-bone. The bottome is presently divided into two parts, which by degrees determine in a sharpe end & do not turne round like the hornes of the womb of an Ewe or Cow, but run out straight. And because these creatures beare many whelps at once in particular parts of their womb, these parts are distinctly implicated or rowled vp like the guts,

These two parts of the bottome [tab. 14. fig. 1. FG] do end in a common orifice, [ta. 14. fig. 1, K] which reacheth vnto the vpper part or seate of the necke. It hath a double coat, one outward from the *Peritoneum*, [tab. 14. fig. 1, DD] from which it hath his processe, the other inward.

The two parts of the bottome.

The Testicles [tab. 14. fig. 1, C] are placed at the tops of the two parts of the bottome. The vessels are like those of an Ewe before described, but they haue no such knobbes in the cauities, as we spake of in the former.

The testicles vessels.

It is a strange thing which *Gesner* and others doe write, that in *Paria* a Prouince not farre from the Region of the *Patagons* in the West India, there is a creature found which our Countrey men call a halfe Fox. For it hath two wombs, one inward in which they generate as other creatures do, the other outward scituated vnder the former wherein they cherish and defend their Cubbes, and out of which they seldome take them but when they would sucke. Heere we will put an end to our History of the parts of Generation, and come to the Controuersies.

A strange creature in the West India.



A Dilucidation or Exposition of the Controuersies of the fourth Booke.

QUEST. I.

Whether the Testicles be principall parts or no.

Aristotle and the *Peripatetick* philosophers do admit but one principall or chiefe part in the body of man which is the Heart; but their opinion is long agoe hissed out of the Physitians Schoole. Many do accuse *Galen* of leuirty & inconstancy in assigning the number of the principall parts. For sometimes he accounteth the Testicles among the principall parts, sometimes he excludeth them, but it will not be hard for vs to reconcile *Galen* vnto himselfe.

The Peripatetians.

Galen accused but redeemed. Lib. de sem. de arte parua. G. de usu part. G. de placitu.

The testicles alter the temper, habit, and manners.

The Testicles, because they are the chiefe Organes or instruments of procreation and by procreation mankind is preserved, are therefore to be accounted principall parts; and haply so much are they more excellent then the heart, by how much the species or whole kinde is more noble then one *individuum* or particular of the kinde. Surely the power and vertue of the Testicles is very great and incredible, not onely to make the body fruitfull, but also in the alteration of the temperament, the habit, the proper substance of the body, yea and of the manners themselves. In these doth *Galen* place, beside that in the heart, another hearth as it were of the inbred heate, and these are the household Goddesses which doe blesse and warme the whole bodye. Hence it is, that the Egyptians in their Hieroglyphickes doe paint *Typhon* gelt, signifying thereby his power and soueraignty to be abolished and decayed.

Why the Egyptians painted Typhon gelt.

That they change the temperament it is manifest, because the testicles being taken away or but fretted, contorred or writhen, yea refrigerated, or hauing suffred convulsion, there presently followeth a change from a hot to a cold temper, and in olde time it was accounted a singular remedy for the leprosie to cut off the Testicles, and to this day we vse to apply Epithymations to them, and finde that they doe wonderfully corroborate and strengthen the whole frame of the body. And it is ordinary for women (and that not without reason) to presume much vpon the death or recovery of children by the firmenesse or loosenesse of these parts; yea *Hippocrates* himselfe saith in his prognostickes, *That the Convulsion of the testicles and priuy parts do threaten danger of death.*

The temperament.

Prognostication by the Testicles. The habite.

We see also that in gelt men called Eunuches, there is a change of the whole habit and proper substance of the body, for they become fatter and smooth without haire; the flower also of their blood decayeth and their vessels or veines lose their bredth and capacity, and

all vigour of lust and desire of ioylity is extinguished; beside the flesh of such creatures loseth the former tast and smell; for whereas before it breathed out a certaine vnsauoury and rammish sowrenesse, after they are gelt it becommeth sweete and pleasant to the taste.

The manners.

Concerning the chaunge of their Manners, that is notable of *Auenzoar* the Arabian, where he saith, Eunuchs haue a shrill and piping voice, euill manners, and worse dispositions, neyther shal you lightly finde one of them of a good inclination, or not broken witted. *Claudian* against *Eutropius* inueyeth thus against Eunuchs.

Adde quod Eunuchus nulla pietate mouetur,

Nec Generi natusque cauet.

The Eunuch is deuoid of pietie,

Both to his Parents and his Progenie.

Xenophon.

Why gelt men
are so changed

Aristotles prety
conceits.

Comparison.

Confuted by
Galen.

The common
opinion.

Galen's opinion

Not altogether
allowed.

Comparison

Galen redce-
med.

Atwofold in-
fluence of heat.

Albeit in the seuenth Booke of the *Institution* of *Cyrus* it is recorded, that this kind of men is quiet, diligent, and especially faithfull: but we may answere that they are quiet because they are dull and blockish; diligent because they are seruile and base-minded; faithfull because they haue so much distrust of themselves. But howsoeuer, whence comes trow wee this so sudden alteration of the temper, habit and maners? *Aristotle* thinketh that the heart is stretched by the testicles, and therefore relaxed when they are cut away, and so a common principle affected, because the strength of the Nerues is relaxed or loosened in their originall or beginning. Euen as wee see it commeth to passe in instruments, which haue a more acute or trebble sound when the strings are stretched, and a lower and more remisse when they are loosened; right so in Eunuchs, the Testicles being taken away and so the heart affected, the voice and very forme becommeth womanish; for a principle though it be smal in quantity, yet it is great in power and efficacy.

Against this opinion of *Aristotle* *Galen* disputeth in his Booke *de Semine*, and we in our next exercise shall prosecute it at large: for neither doeth the strength of the heart depend vpon the contention or stretching of the Testicles but vpon his owne proper temper; neither if the heart needed any such tension or stretching, were the testicles pinnes fitting for the same. The Common opinion is that all the other parts are heated by the repercussion of heate from the Testicles vnto them; but because their substance is soft and rare, and reflection or repercussion is vsually (especially if it be any thing) from thigh and hollow bodies, I imagine that their small and slender reflection can be no cause or author of so powerfull a heat as the parts do stand in need of. *Galen* referres this alteration to the native and ingenit temper of the testicles themselves; for in the place last before named he sayth, that in them there is another fountaine or furnace rather of heate, euen as there is in the heart. But vnder correction it seemeth to me more reasonable, that the heate of the Testicles is not so much from their native and in-bred temper, because they are without blood and like vnto Glandes, as by reason of the seede conteyned in them; for where that is it heateth the whole body, distendeth yea enrageth it. For *Hippocrates* saith, that seede is of Nature fiery and aery; by the aery part it distendeth the whole frame of Nature, and by the fiery setteth it on worke, or a gog as we say, transporting not the body onely, but the minde also from reason to rage. For as the least part of mortall poyson in a moment changeth the whole body; so is it in seede, whose quality is so active and operative, that it darteth forth as it were by irradiation his beames through the whole body. And thence it is, that we see gelt creatures are not so stirring as others, whose many motions do stirre vp and so encrease their heate.

It may be objected that *Galen* in another place attributeth onely to the Liuer and the Heart power to change the whole body, not to the Testicles. For thus hee sayeth: *Those that haue hot Liuers haue also all their Habit hot, vnlesse there bee some obstacle in the Heart: on the other side they that haue hot Heartes haue also hot Habites, vnlesse the Liuer doe vehemently oppose against it:* but of the Testicles not one worde or any mention at all; this obiection may thus be satisfied.

There is a twofold influence of heate, one immediate, another mediate. The immediate influence of the two-fold spirits and bloud and with them of the heate, is from the heart and liuer by the veins and arteries. The mediate is from the Testicles into the whole body indeede, but by the mediation of the Heart, the Liuer and the common vessels. For the Testicles haue no peculiar vessels by which they might deriue their influence into the whole body; but they impart this power and faculty of alteration to the Heart by the arteries, to the Liuer by the veins; from which it is againe reinfused into the particular members.

It will be objected that this faculty of alteration proceeding from the Testicles is infused

not

not bodily but onely operatiuely; what neede then hath it of a conduite or pipe either arteriall or venall? But I answere, that faculties doe not vse to bee infused or transfused but by the mediation of spirits, which although they wander and gad vp and downe the body; yet notwithstanding they stand neede of peculiar receptacles to containe them in, such as are the veines, nerues, and arteries. So poyson although in the specificall or essentiall forme it opposeth the heart, yet is it carried in a moment of time and matter to the heart through the arteries and spirits wherein the faculties haue their consistence.

How faculties are infused.

Such therefore is the excellency, such the admirable faculty of the Testicles, as well in procreation of seede (as we shall declare in our next exercise) as also in the alteration of the temper, habit and manners; and in that respect are they called by *Galen*, *principall parts*.

Comparison

But there want not aduersaries who would thrust them out of this ranke of dignity; although their arguments are very weake. First they say *Galen* in two places defineth a principall part, in the first by *Necessity*, in the second by *communication of a faculty or some common matter*. But for the Testicles there is no necessity of them, for *Eunuches* liue without them, neither is there any faculty proceeding from them; for the animall faculty proceedeth from the braine, the vitall from the heart, the naturall (to which the faculty of procreation is referred) issueth from the Liuer the chiefe of all naturall partes. Moreouer from the Testicles there is no matter communicated to the whole body, for they haue no spirits proper vnto them, no vesselles which runne through the body by which it may bee conuayed; but these are trifles.

Obiections.

What a principall part is according to *Galen*.

For we confesse the Testicles are not necessary for conseruation of the life of the *indivisible* or singular man, but for propagation of the whole *species*, or of *mankinde*, they are of absolute necessity. Wherefore they are principal parts in respect of mankind, not in respect of this or that particular man. For the propagation of mankind is onely accomplished by procreation: procreation is not without seede, seed is only concocted and perfected by the Testicles, to which the spermatike vesselles doe serue as well for preparation as for conduction and leading of the same.

Answered.

But me thinkes I heare the *Peripatetians* obstreperously deny the Testicles this power of procreation of seede, against whome we will in the next place bend our forces.

Obiections of the preparation of seed.

QVEST. II.

Of the vse of the Testicles.

Concerning the vse of the Testicles there are diuerse opinions, and those farre differing one from another. *Aristotle* denyeth them the vertue of making seed and attributeth it onely to the spermatike vesselles, because many creatures want Testicles, as Fishes and Serpents, which yet enioy a coition, and doe auoyde perfect seede able to propagate their *species* or kinde. That a Bull or Horse hauing lost their Testicles may yet presently couple with their Females and procreate, and finally because they accomplish or fill vp no part of the passages; that is, haue no sociery with the spermatike vesselles. He taketh knowledge of other vses of these Testicles which he maketh to be threefold.

Aristotles opinion. His arguments. 3. *Hist. Ani. I.* 6. 1. *de gener. Anim. 4.*

The first, that they establisth the motion of the seede, and hanging at the vesselles inuerted or writhen with a wonderfull art, doe hold them together and make them more patent and ample, (as we see weauers hang waights at the strings of their warp) and therefore when they are cut off, the spermatike vesselles are contracted and their passages occluded or shut vp so as the seede can haue no passage. The second vse of the Testicles is for the strength of the heart, for by these as by certain waights the heart is streatched, and thence proceedeth the change of the Temperament and whole habit when they are taken away, the bridle being loosed and the strength of the heart so as it were dissolued or resolued. The third vse I gather out of his Problemes; that by their waight & poyse they should helpe the tension or erection of the yarde. And this is *Aristotles* opinion of the vse of the Testicles, which we will now bring to the touch-stone to see how it will hold.

His threefold vse of them.

Comparison.

For the first vse he may well be confuted by himselfe: the vesselles of seede sayeth he are writhen and intorted with wonderfull art, and implicated or foulded vp in many boughts and circumuolutions; the waight therefore of the Testicles should bee so far from dilating their

Confutation of the first vse

their passages, that if they did stretch them they would rather draw them out in length euen vnto the feete. But the truth is, that these vessels are so firmly tyed to the neighbour parts that they admit no stretching or tension at all, or if they should be stretched they would not onely not be dilated, but they would become narrower and straighter; for vessels when they are stretched out in length cling closer together.

No vse of any
sensible cau-
ty for the seed

Obiection.

Solution.

But what vse is there of any such sensible cavity or amplitude for the excretion or mission of seede? Is there not seede containd in the substance of the Testicles and of the *Epididymis* in which there is no sensible or conspicuous cavity? and is not the seede led along by the leading vessels to the small bladders and *Prostate*, and there kept in readines for effusion without any cavity? The seede it selfe is hoven with abundance of spirits which maketh it to passe *orgasmo*, that is, with a kinde of impetuous violence. If it be objected that seede is thicker then arteriall blood which yet hath need of a conspicuous canell or pipe to passe in as are the arteries: I answer, that the arteriall blood is a plentifull streame ordaind to water the whole body with a continuall and abundant influxion, which could not bee without very patent and open passages; so Nature formed the arteriall veine large and ample, that it might be sufficient to nourish the Lungs, a rare body and in continuall motion. But the seede falleth by degrees and insinuateth it selfe rather then floweth into the spermatike vessels, and is first prepared in their circumuolutions and after is deriued through small pores and hairy passages into the substance of the Testicles, and is thence driuen into the eiacularie vessels which are indeed porous as an Indian Reede, but haue no sensible cavity at all. There is not therefore required any such rectitude and amplitude in the vessels or substances conteyning the seede as *Aristotle* dreamt of, either for the concoction or eiaculation and auoyding thereof.

Arguments a-
gainst *Aristot.*

But let vs presse *Aristotle* a little farther, although the Testicles doe hang in their due place, yet doe those men become lesse apt for generation who haue their Testicles bruised or worne and wasted or refrigerated, so that euen thence it is manifest that their chiefe vse is not to stretch or dilate the vessels: besides many creatures haue their Testicles within tyed to their backs, and yet are as fruitfull as any other; as some Tuppes or Rammes called Riggall Tuppes, and all female creatures who are very prolifike though their Testicles hang not at all. Furthermore if the Testicles were made as waights to keepe the passages open; then in the time of coition or generation and eiaculation of seede the Testicles should descend downward that the passages might bee made more patent and open: but we finde the quite contrary to be true, that in coition the Testicles are contracted & drawn vpward, not let lower downward. *Aristotles* nice conceited vse therefore is but supposititious & not the true vse of Nature. *Auerrhois* being not able to auoyde the strength of these reasons, departeth from *Aristotles* opinion to whome he was so much addicted, and yeeldeth that the Testicles haue power to procreate seede.

Confutation
of the 2. vse.

The second vse ascribed to the Testicles by *Aristotle*, is for the tension and strengthening of the heart, to which we answer: that they bee of small waight, neither doe they hang at the heart vnlesse it be by arteries, and those not right but oblique, and yet those adhearing and tyed to the neighbour partes so as the Testicles cannot by them stretch or bend the heart: againe if this were a vse truly assigned, then their hearts and vigor should be strongest whose Testicles are more relaxed and hung lower: but women finde these much more impotent, and account them lazie loyned fellows: adde hereto, that if the heart needed any tension, it might better haue beene tentered, and with shorter stringes to the spine of the backe; also the Liuer is very neare and a waighty body, and tyed to the heart by the hollow veine, and therefore certainly stretcheth it more then the smal bodies of the Testicles placed so farre off and so slenderly depending vpon it, and that by stringes fastned to the backe by the way: moreouer the vessels which leade to the Testicles are diuersly contorted, and if they were stretched out woulde reach vnto a mans feete almost; againe, all creatures whose Testicles are hidde within should be faynt and crauen-hearted. Finally if this were true, the heart which is a most noble part should haue his strength not of himselfe but by dependency from else where, which were a great absurditie in reason. Wherefore we think this opinion of *Aristotles* to bee but a quaint deuice, worthy of the wit but not of the iudgement of so great a Philosopher.

Confutation
of the last vse.

As for the last vse assigned by *Aristotle* which is the erection of the yarde, that may be confuted by that we haue sayd before to be the true cause of erection, and that is partly Natural, to wit, an abundance of winde and spirits filling the hollow Nerves; and partly Animal,

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We will there
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Epididymis and
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Now *Hippoc*
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small, from an appetite moving the muscles which are appoynted to make this erection. We will therefore bid adue vnto *Aristotle* his faigned conceite, and to them also who deny vnto the Testicles the power of procreating feede: for whereas they obiekt that there are many creatures which haue no Testicles and yet doe abound with feede prolifique or fitte for generation: wee answere that such Creatures are imperfect and their generation not perfect but lame.

To conclude, that a new gelt Horse or Bull can copulate and ingender seemeth hard to be beleued, because of the extreame payne that must necessarily follow the violation of parts of so exquisite sence; but if it do so come to passe, then is it by that seed that is already laboured by the ingenit power of the Testicles before they were separated, and reserued for present vse in the *Parastate* and *Prostate*; and not by any seed concocted after the taking away of the Testicles.

Obiection.

Solution.

How a new
gelt horse
may get a
foale.

QUEST. III.

The opinion of Physitians concerning the true vse of the Testicles.



Here are some not vnlearned Physitians, who will not allow to the Testicles any power of procreating feede, but reserue that onely for the preparing vessels and the *Epididymis*; because there appeare no passages by which the seed should passe from the bunching implications of the vessels into the Testicles: againe the *Epididymis* and the preparing and leading vessels may be separated without rending from the Testicle: adde hereto that the *Epididymis* is often full of white feede, which is rarely found in the Testicle it selfe. They therefore say that the Testicles were made to sucke away the serous humour and excrement of the seed and to conteyne it, for which reason their substance is glandulous.

The opinion
of some Phy-
sitians.

Their reasons.

What vse
they assigne
to the testicles.

Now *Hippocrates* assigneth this vse to Glandules to receiue the excrements of the parts, & therefore the Braine, the Heart, and the Liuer, haue their seuerall Emunctories. But for my owne part I see no reason why the excrement of the seed should rather passe into the substance of the Testicles then the seed it self, which is so hoven and barded as it were with spirits: besides the body of the Testicles is rare and spongy, and hath many small pipes inserted into them out of the vessels; wherefore through these smal and almost insensible passages, they sucke the feede by an ingenit faculty of their owne; for if Aliment be brought vnto them to nourish them, and yet there are no conspicuous vessels disseminated through their substance, I see no reason but seed also may without manifest vessels be conueyed into them. Their bodies are indeed glandulous or resembling Glandules, but very Glandules they are not, as is sayd already. The third opinion concerning the vse of the Testicles is theirs who thinke, that they are ordayned for Pillowes to safe-gard and strengthen the vessels. For say they where there is any notable partition of vessels in the whole body, there Nature hath appoynted glandules as pillowes to secure them. So is the *Pancreas* placed vnder the diuision of the *vena porta* or Gate veine, many glandules are in the diuications of the veines of the mesentery: the *Thymus* vnder the *subclavian* diuision, and vnder the axillary and crurall veines notorious glandules or kernels are to bee found: in like manner the Testicles are appointed for the security of the spermatieall vessels. But the truth is that the onely ignorance of Anatomy brought in this old wifes fable. For the kernels or glandules which are placed at the diuisions of the vessels, do on euery side sustaine, establish and support them; but the Testicles are hung only at the ends of the vessels.

Answer to
them.Another opi-
nion.Which igno-
rance of Ana-
tomy hath
brought forth

Wherefore the opinion of *Hippocrates*, *Galen* and almost of all the Physitians is much more probable, who doe attribute to the testicles a power of their owne to procreate seed, and the prime place in the worke of generation, because they haue a great power for alteration of the habit, the temperament and the manners themselves. Moreover those creatures who haue abstained long from the worke of generation, haue their Testicles swolne and distended with feede, which vpon the vse of the Female doe abate againe. Which thing also *Aristotle* himselfe hath left testimony of where he sayeth: That certaine Birds and Beastes at what time they vse to couple, haue their Testicles very great, but when that season is over, they become so small that it may be doubted whether they haue any Testicles at all or no: and againe when the Testicles are refrigerated or ouer-cooled, then barrennes followeth. And truly

The true opi-
nion of almost
all Physitians.

Their reasons.

Diuerse in-
stances,

truely if a man list to runne ouer all the concoctions in the body of a man, hee shall finde that there is onely a preparation in the vessels, but concoction and perfect elaboration to be in and from the particular substance of the part.

The Animall spirit as we shall declare hereafter, is prepared in the wonderfull implications and texture of the arteries, but his forme and proper difference it acquireth in the marrowy substance or ventricles of the braine. The Milke is prepared in the veines but groweth white in the glandules of the Breaſtes. Blood getteth a kinde of rudiment in the veines of the mesentery, but his rednesse and the forme of blood it onely obteyneth in and by the *Parenchyma* or substance of the Liuer.

The true
course of the
seede.

In the small and threddy veynes of the particular parts there is a preparation vnto the third concoction, but assimilation is onely made by and in the substance of the parts. So there is a delineation and preparation of seede in the spermatike vessels, which are diuersly implicated by a wonderfull artifice of nature, that in those implications the spirits might be exactly mingled with the blood, and therefore here an artery entreth into a veine, and there a veine into an artery. The seede thus prepared the Testicles draw for their nourishment, to which they giue forme, perfection and foecundity, wherewith when they are satisfied, the remainder they expell into the leading vessels: these doe exonerate themselves into many small bladders, and into the *Prostate*, and there it is reserued and kept in store for the necessary vse of Nature in Procreation.

QUEST. IIII.

Of the substance and coates of the Testicles.

That the Te-
sticles are not
glandules.
The difference
betweene a
glandule and
a glandulous
body.



He substance of the Testicles some say are Glandules, allcading *Galen*, who reckoneth them among the Glandules in his third Booke *de Alimentis*: and *Hippocrates* in his Booke of Glandules defineth them to be spongy, rare, fatte and friable; but such are the Testicles, therefore they are Glandules. We answer that we must distinguish betweene Glandules and glandulous bodies. The Testicles are indeede glandulous bodies, so are the Kidneyes, so is the Braine, yet no man will call it a Glandule, but the body of it is like a Glandule, as wee shall shew more at large when we speake of the Braine.

Of their coat.
How many
coates stones
haue.

*Varicozum cor-
pus.*

Againe, concerning the coates of the Testicles, Anatomists doe differ one from another, some make more, some fewer: we resolue they are foure; two common and two proper: the two common are called *scrotum* or the Cod and *darton*: the two proper called *Eleutheroides* the first, & *Varicozum*, that is, the neruous membrane the latter *Vesalius* calleth this *Epididymida*, but *Falopius* elegantly confuteth him; for the *Epididymis* is indeede that we call *Parastata*, and is a body nota membrane, a little Testicle not a coate of the Testicle as the word signifieth: euen as a Cuticle is a small skinne; the *Epiglottis* a small tounge as it were. And *Galen* in the 15. and 16. Chapters of his Booke *de semine* calleth the *Epididymis* a particle fixed to the head of the Testicle, which wee haue seene to swell notably, the Testicle it selfe not being taynted at all, yea, and many *Epilepti*all fittes to arise therefrom.

The Testicles of women haue not this additament, or if they haue it is so smal that it cannot be perceiued. The reason may be because it was not necessary that their seede should be so laboured or thicke as that of mens, but remaineth more moyst and fluid, as it were to temper the action of the seede of man.

QUEST. V.

Of the consent betweene the Chest and the Testicles.

The consent
betweene the
Chest and the
testicles.
Three places
of Hippocrates
expounded.



HE Consent betweene the Chest and the Testicles is expressed by *Hippocrates* in three seuerall places. In the first Section of the second Booke *Epid.* he sayeth, *When the Testicle swelleth after a Cough, it calleth to our remembrance the consent or sympathy betweene the Chest, the Breaſts, the Seede and the Voice.* Againe, in the first Section of the first Booke thus; *Many were overtaken with dry Coughes, and many of those men long after were troubled with painful inflammations, sometimes in one stone, sometimes in both.* Thirdly, in the first againe of the second Booke thus: *Long and inueterate Coughes doe cease when the Testicles begin to swell.* Howe this commeth to

What Hippo.
meaneth by a
dry cough.

pasle

pasſe we will now declare: but firſt it muſt be reſolued what that diuine old man meant by dry Coughes; not that Cough which is without matter; cauſed either by a bare diſtemper as when the winde is at the North, or by the inequality of the rough Artery, or by the ſympathy of the ſinnewy parts, for how could that breede tumors and Apoſtemations? But a Cough with a matter, whoſe cauſe is either the thinneſſe of the matter, which the breath cannot intercept as we cough, but it ſlideth downe by the ſides of the weazon; or elſe the thicknes of the ſame which will not follow the conſtraint of the cheſt. This matter whether thin or thicke Hippocrates vnderſtandeth to be euacuated by Apoſtemations belowe, and eſpecially in the coddies or teſticles: but all the difficulty is, which way this crude matter ſhould paſſe out of the cheſt vnto the parts of generation.

There are threee ſorts of veſſels which goe to the Teſticles; A Nerue, an Artery, and a veine, all which haue through-paſſages from the cheſt to the teſticles. Firſt of all, a notable and euident branch of the rib ſinnew called *Coſtalis*, runneth by the ſides of the ribs into the Teſticles. A veine from the *non-parill* or vn-mated veine of the breſt runneth thorough the Midriffe, and determineth into the veine of the Kidney, and the ſpermatieall veines. As for the Artery, albeit none do come to the great trunk from the Lunges (in whoſe lappes the matter of the cough doth lye) yet it is not vnreaſonable to thinke that the offending humour may paſſe by the venall artery into the left ventricle of the heart, and from thence into the great artery, & ſo into his branches; by which way alſo the matter or *pus* of *pleuriticall* and *Peripneumonicall*, or *Empyricall* patients deſcendeth, and ſo is diuerſly auoyded by vrine, ſeidge, or Apoſtemations in the lower parts; and by this paſſage alſo it is more then probable, that the matter ſhould fall out of the cheſt to the teſticles.

The wayes by which the humor muſt paſſe out of the cheſt into the teſticles.

The way of the nerue.

The way of the Veine.

The way of the Artery.

The paſſage of matter thorough the left Ventricle of the heart.

QUEST. VI.

Of the ſituation of the Proſtate.



Concerning the Glandules called *Proſtate*, Anatomists doe contend; ſome thinke they are placed beneath the ſphincter Muſcle, others aboue, we adhere to the latter. For, beſide the credite of diſſection, if they were placed below the ſphincter then the ſeede ſhould neuer be ſpent without the auoyding of vrine alſo, and againe in the running of the reines, the ſeede could not flow without the water; beſides the Vrine would alwayes lye vpon theſe Glandules and fret them with his acrimony. They are therefore placed aboue the ſphincter, and their inflammation or exulceration breeds the venerious gnorrhæa or running of the reines.

That the Proſtates are aboue the ſphincter.

QUEST. VII.

Whether the Erection of the yard be a Naturall or an Animall action.



Very action according to *Galen*, is Naturall or Animall; that he calleth Naturall which is not voluntary, ſo the vitall faculty is Natural becauſe it is not Arbitrary. The inflation of the virile member is an action, becauſe there is in it Locall and Mathematical motion, it muſt therefore needs be a Natural or an Animal, or a mixt action.

How many ſorts of actions there are.

That erection is meere Animall.

To prooue it to be meere Animall this argument is vrged, becauſe all the Animall faculties, Imagination, Motion, and Senſe do concur to the perfection of it. For the firſt, before the diſtention of this part, whether we wake or ſleepe, wanton and laſciuious imaginations do trouble vs. Now mens Imaginations when they wake are alwayes voluntary and arbitrary with election, & when they ſleepe, then are their imaginations like thoſe of brute beaſts, following the ſpecies or Idea and representations of the ſeede as it pricketh and ſwelleth theſe parts of generation. For euen as in ſleepe Flegme ſtirreth vp in our imaginations ſimilitudes of raines and waters, Choler of rage and fury like vnto it ſelfe, Melancholy that enemy of the light and demolisher of the principles of life it ſelfe, powreth a cloude of darkneſſe ouer our minde, and repreſenteth to our imaginations ſimilitudes full of terror and feare: right ſo the ſeede contained in the *Proſtate* ſwelling with abundance by his tickling,

The effects of the humors in ſleepe.

How veneri-
on imaginati-
ons in sleep are
moued.

tickling or itching quality communicated to the braine by the continuity of the sinnewes, moueth or stirreth vp images or shaddowes of venerious delights in the fantasies of men, wherefore this part or member is not erected without the helpe of the imagination.

The Sense moueth the imagination, the imagination commandeth the mouing Faculty, that obeyeth, and so it is puffed vp. The mouing Faculty hath the help of four Muscles, two of which run a long the sides of the member; now wee know that all motions of the Muscles is Animall, because a Muscle is defined to be an instrument of voluntary motion. This inflation hath pleasure also ioyned vnto it, but pleasure is not without sence; wherefore all these three Animall faculties concur in erection, and therefore it is meerly an Animall action.

That it is
meerly natu-
rall
The instru-
ments.

The efficient.

The finall.

The middle &
true opinion
that it is a mixt
action.

Comparison
from the ap-
petite.

On the contrary that it is a Naturall action may thus bee demonstrated: all the causes of his distention, the instruments, the efficient and the end are Naturall. The Naturall organs or instruments are two ligaments, hollow, fungous and blacke, which though they be called Nerues, yet are not voluntary and sensible or feeling sinnewes; they arise from the hanch and share-bones, not from the brayne or marrow of the backe. The efficient cause is not our will, because erection is not alwayes at our commaundement either to moue or to appease as we may doe our armes, legges and eyes; but the efficient cause is heate, spirites and winde, which fill and distend these hollow bodies, with an infinite number of vesselles both veines and arteries dispersed and wouen through them. The finall cause is procreation which belongeth to the Naturall not to the Animall faculty.

Betwixt these two extreames we wil take the middle way and determine, that the action of erection is neyther meerly Animall nor meere Naturall, but a mixed action. In respect of the imagination and the sence it is Animall, because it is not distended vnlesse some luxurious imagination goe before, and the distention when it is made is alwayes accompanied with a sence of pleasure and delight; but in respect of the motion we rather thinke it to be Naturall which yet is somewhat holpen by the Animall. For as the appetite which is stirred vp in the vppermost mouth of the stomacke (because traction breedes diuulsion, diuulsion sence, sence Appetite) is called Animall; and yet the motion wherby the greedy stomack sometimes snatcheth vnchewed meate euen out of the mouth is Natural: so the erection of this member because it is with sence and imagination is sayed to bee Animall, but the local motion whereby it is mathematically enlarged is Natural, arising from the inbred faculty of the ligaments: such is also the motion of the wombe when it draweth seede, and of the heart when it draweth into it selfe ayre and blood. Yet it must be confessed that this natural motion is holpen by the Animal, because the foure muscles before mentioned though they be very small, yet they helpe to enlarge the distention, and doe also for a time keepe it so distended.

Obiection.

Solution.

Comparisons.

Priapismus.

The causes of
it.

Melancholy
men subiect to
it and why.

If it be obiected that in the running of the Reynes called the venereall *Gonorrhoea*, there is erection without imagination or pleasure, yea with payne. I answer with *Galen* that there is a twofould erection, one according to nature, another vnnaturall; the first is from the ingnit faculty of the hollow ligament; the other is symptomaticall; the first with pleasure, the other without it yea with payne; in the first the yarde is first distended and after filled with a vaporous spirite; in the latter it is first filled then after distended. In a word, there is the same difference betweene these two distentions which is betweene the two motions of the heart. In the Natural motion of the heart which is accomplished by the vital faculty, because the heart is dilated it is filled with ayre and blood, and because it is contracted it is emptied; but in the depraued palpitation of the heart the heart is distended because it is filled. So smiths bellows because they are dilated are presently filled with ayre for the auoyding of vacuity, but bottles are distended because they are filled with wine or water.

Wherefore the Naturall erection euer followeth imagination and hath pleasure accompanying it, but the vnnaturall which *Galen* calleth *Priapismus*, is altogether without lust or appetite. The cause of this is a plenitude of thicke and crasse wind, proued because the motion is so sudden and so violent; for all violent and sudden motions are of winde not of humor as *Galen* saith; and this wind or vapour is generated either in the hollow nerues and ligaments, or is thither brought by the open passages of the arteries. But of what? Surely of crasse and thicke humours, and that is the reason why melancholly men are most troubled with this vnnaturall erection; as also are Lepers, and therefore the Ancients called the Leprosic *Satyriasis*. And thus much concerning the parts of generation in men, now it followeth concerning those of women.

QUEST. VIII.

How the parts of generation in men and women doe differ.

CONCERNING the parts of generation in women, it is a great and notable question whether they differ onely in situation from those of men. For the ancients haue thought that a woman might become a man, but not on the contrary side a man become a woman. For they say that the parts of generation in women ly hid, because the strength of their naturall heate is weaker then in men in whom it thrusteth those parts outward. Women haue spermaticall vessels, aswel preparing as leading vessels & testicles which boile the blood, and a kinde of yard also, which they say is the necke of the wombe if it be inuerterd. Finally, the bottome of the womb distinguished by the middle line, is the very same with the cod or *scrotum*. This *Galen* often vrgeth indiuers of his works as before is saide; so *Agineta*, *Anicen*, *Rasis*, and all of the Greeke & Arabian Families, with whom all Anatomists do consent. For confirmation also heereof there are many stories current among ancient and moderne writers of many woemen turned into men: some of which we will not heere thinke much to remember. First therefore we reade that at Rome when *Licinius Crassus*, and *Cassius Longinus* were Consuls, the seruant of one *Cassius* of a maide became a young man, and was thereupon led aside into the desert Island of the Sooth-sayers. *Mutianus Licinius* reporteth, that at *Argos* in Greece, he saw a maide named *Arescusa*, who after she was married became a man and had a beard, and after married another woman by whom she had yssue.

Pliny also writeth, that he saw in *Affrica* *P. Cossitius* a Citizen of *Tisdetra*, who of a woman the day before became a man the next day. The *Hyena* also a cruell and subtile beast, doth euery other yeare change her sexe. Of whom, *Ouid* in the 15. of his *Metamorphosis* saith.

Et qua modo femina tergo

Passa marem, nunc esse marem miramur Hyenam.

The same *Hyena* which we saw admit the male before,

To couer now her female mate, we can but wonder sore.

Pontanus hath the same of *Iphis* in an elegant verse:

Vota puer soluit que femina voverat Iphis.

Iphis her vow benempt a Maide,

But turned boy her vow she paid.

Of later times. *Volateran* a Cardinall saith, that in the time of Pope *Alexander* the sixth he saw at Rome a virgin, who on the day of her mariage had suddenly a virile member grown out of her body. We reade also that there was at *Auscis* in *Vasconia*, a man of aboute sixtie yeares of age, grey, strong and hairy, who had beene before a woman till the age of 15. yeares, or till within 15. yeares of threescore, yet at length by accident of a fall, the Ligaments (saith my Author) being broken, her priuities came outward, and she changed her sex; before which change she had neuer had her courses. *Pontanus* witnesseth that a Fishermans wench of *Caieta* of fourteene yeares olde became suddenly a young springall. The same happened to *Emilia* the wife of *Antonie Spensa* a Citizen of *Ebula*, when she had beene twelues yeares a married woman.

In the time of *Ferdinand* the first K. of *Naples*, *Carlota* and *Francisca* the daughters of *Ludouiske Quarna* of *Salernum*, when they were 15. yeares old changed their sex. *Amatus Lusitanus* testifieth in his Centuries that hee saw the same at *Conibrica* a famous towne of *Portugall*. There standeth vpon record in the eight section of the sixth Booke of *Hippocrates* his *Epidemia*, an elegant History of one *Phaetusa*, who when her husband was banished was so ouergrown with sorrow, that before her time her courses vtterly stopped and her body became manlike and hairy all ouer, and she had a beard and her voice grew stronger. The same also he recordeth to haue hapned to *Namisa* the wife of *Gorgippus* in *Thaso*.

Wherefore say they, if a Woman may become a man and her parts of generation which before lay hid within may come foorth and hang as mens do, then do women differ from men onely in the scite or position of their parts of generation.

Notwithstanding all this, against this opinion there are two mighty arguments: one is taken from the *avro-ia* in dissection, another from reason, which two are the Philosophers Bloud-bounds, by which they tract the causes of things.

For first of all (saith *Laurentius*) these partes in men and women differ in number. The small bladders which first *Herophilus* found, and called *varicosos adstites*, that is, the *Parastata*

Whether the parts of generation in men and women do onely differ in situation.

Reasons for it.

Authort.

Examples.
Cassius Maide seruant.

Arescusa.

Cossitius.
The *Hyena*.

Iphis.

A story of *Volateran* the Cardinall.
Another in *Auscis*.

A Fishermans wench of *Caieta*.
Emilia.

Carlota and *Francisca*.
Amatus Lusitanus his story.
Hippocrates his *Phaetusa*.

Namisa.

Reasons and experience against the former opinion.
From the number of the parts.

What parts of
man a woman
wanteth.

From the form
and structure
of the parts.

Concerning
Fallopian his
Clitoris.

Concerning
the Cod and
the bottome of
the wombe.

The insertion
of the sperma-
ticke vessels.

Answer to
the Objection
of the change
of sexes.
The first.
The second.

The third.

A story.

Answer to
the authoritie
of Hippocrates.

How the
womb is saide
to moue.

A threefold
motion.

stata, women haue not at all; nor the *Prostata* which are placed at the roote of the yard and necke of the bladder, in which seede is treasured vp for the necessary vses of nature; althogh there be some that think that women haue them but so sma! that they are insensible, which is (saith he) to begge the question. Againe, me thinks it is very absurd to say, that the neck of the wombe inuerted is like the member of a man; for the necke of the wombe hath but one cauity, and that is long and large like a sheath to receiue the virile member: but the member or yard of a man consisteth of two hollow Nerues, a common passage for seede and vrine, and foure Muscles. Neyther is the cauity of a mans yard so large and ample as that of the necke of the wombe. Add to this, that the necke of the bladder in women doth not equall in length the necke of the womb, but in men it equalleth the whole length of the member or yard. Howfoeuer therefore the necke of the wombe shall be inuerted, yet will it neuer make the virile member: for three hollow bodies cannot be made of one, but the yard consisteth of three hollow bodies; two Ligaments arising from bones and the *epididyma*, as we haue before sufficiently shewed. If any man instance in the *Tentigo* of the Ancients, or *Fallopian* his *Clitoris*, bearing the shape of a mans yard, as which hath two Ligaments and foure Muscles, yet see how these two differ. The *Clitoris* is a small body, not continued at all with the bladder, but placed in the height of the lap, the *Clitoris* hath no passage for the emission of seede; but the virile member is long and hath a passage in the midst by which it powreth seede into the necke of the wombe.

Neither is there (saith *Laurentius*) any similitude betweene the bottome of the wombe inuerted, and the *scrotum* or cod of a man: For the cod is a rugous and thin skin, the bottome of the wombe is a very thicke and thight membrane, all fleshy within and wouen with manifold fibres.

Finally, the insertion of the spermatick vessels, the different figure of the mans & womans Testicles, their magnitude, substance and structure or composition doe strongly gainsay this opinion.

But what shall we say to those so many stories of women changed into men? Truly, I thinke saith he, all of them monstrous and some not credible. But if such a thing shall happen, it may well be answered that such parties were Hermaphrodites, that is, had the parts of both sexes, which because of the weakenesse of their heate in their nonage lay hid, but brake out afterward as their heate grew vnto strength. Or we may safely say, that there are some women so hot by nature that their *Clitoris* hangeth forth in the fashion of a mans member, which because it may be distended and againe growe loose and flaccid, may deceiue ignorant people. Againe Midwives may oft be deceiued because of the faultie conformation of those parts, for sometimes the member and testicles are so small, and sinke so deepe into the body that they cannot easily be discerned.

Pitatus writeth, that at *Paris* in the yeare, 1577. in the streete of *S. Denis*, a woman trauelled and brought forth a sonne, which because of the weaknesse of the infant was suddenly baptized for a daughter, and was called *Ioanna*. A fewe dayes after, in dressing the Infant the Mother perceyued it to be a manchild and so did the standers by and they named it *Iohn*.

As for the authority of *Hippocrates*. It followeth not that all those women whose voyces turne strong or haue beards and grow hairy do presently also change their parts of generation; neither doth *Hippocrates* say so, but plainly the contrary: for he addeth, *when we had tried all meanes we could not bring downe her courses, but shee perished*. Wherefore hir parts of generation remained as those of a Woman, although her bodye grew mannish and hairie.

QUEST. IX.

Of the motions of the wombe.

ANOTHER question there is, whether the wombe moue locally and Mathematically, or Physically onely: concerning which we will resolue thus. There is a threefold motion of the womb, one altogether naturall, another altogether symptomaticall and Convulsive; the third mixt, partly Naturall partly Symptomaticall. The Naturall motion is meere from the faculty of the soule; the Symptomaticall meere from an vnhealthfull cause, the third from them both together.

The

The naturall motion is when the wombe draweth seed out of the neck into his bottome, for then it runneth downward to meete it, insomuch that sometimes it hath beene scene euen to fall out; it mooueth also naturally when in conception it is contracted and imbraceth the seede strictly on euery side; as also when it excludeth the Infant, the afterbirth or any other thing containd in it beside Nature. For the accomplishment of this motion it hath right fibres and very many transuerse or ouerthwart, and this motion comes from the necessity of Nature.

The naturall motion of the wombe.

The symptomaticall motion is onely from a cause that is morbus or diseasful and that is convulsive; which motion is manifest in the suffocation of the matrix, for then the womb is moued vpward because it is drawne convulsively; and that comes either from repletion or from exhaustion or emptines, the ligaments either being by drought exsiccated or steeped in ouermuch moysture: sometimes it commeth from a poysonous breath, from the suppression of the courses, or the retention and corruption of the womans seede false into it out of the vessels.

The symptomaticall motion of the wombe. The suffocation or strangulation of the matrix.

In this convulsive motion the midriffe is pressed or borne vp, which is the chiefe instrument of free respiration or breathing, and the braine is also drawn into consent, which is the chiefe seate or tribunall of the Animall faculty, which faculty is the efficient cause of respiration. Hence it is that in such suffocations or strangulations there is an interception of respiration, for the instrumentall cause the midriffe is intercepted, so is the efficient cause the Animall faculty also, because the braine is drawne into consent. The finall cause also is taken away, for the heat of the heart at that time is very small and requireth therefore no other ventilation but by transpiration, which is by the pores of the habit of the body.

Why such women do not breathe.

All the causes of respiration in this suffocation are taken away.

But you must marke that I call not this motion a convulsion, but onely a convulsive motion; for convulsion properly is, an vnbidden motion of those parts which we vse to moue at our commandement, but the wombe is not moued by our willes but by it owne will, wherefore convulsions belong not to the wombe but to the muscles onely which are instruments of voluntary motion; but abusively we may call this a convulsion as Hippocrates calleth the Hiccocke a convulsion.

What parts suffer convulsions.

The third motion of the wombe wee sayed was mixt, proceeding partly from a morbus or vnhealthy cause and partly from the faculty, as in a great exiccation it runneth vpward toward the Liuer which is the fountaine of sweete moysture; for all dried partes doe as it were thirst after this moysture with a naturall appetite; and this motion is indeede truly mixt, being partly physicall or naturall, the dry wombe drawing toward the seate of moysture, or drawing the moysture vnto it selfe as Galen interpreteth it; and partly mathematicall or locall; it moouing as Hippocrates sayeth, with a kinde of impetuous violence to the *precordia*; although I am not ignorant that Galen in this poynt reprooueth his maister, and taketh this motion to be meere Physicall or naturall; and called mathematicall by Hippocrates but abusively onely.

The 3. mixt motions of the wombe.

QUEST. X.

How the wombe is affected with smells and saours.

Furthermore it is not onely recorded by ancient Authors, but approued by daily experience, that the wombe is much affected with saours and smells; so that some haue beene knowne to miscarry vpon the stench of a candle put out as Aristotle recordeth in his 8. Booke of the History of Creatures and the 24. Chapter. But how and by what passages this apprehension of odours is, few haue sufficiently declared; wherefore we will payne our selues a little and our readers also, to lay open this difficulty, because it may be of great vse for the preservation of health, and will not be altogether vnpleasant to them that desire to know themselves.

How the wombe is affected with smells & saours.

As therefore Colour is the onely obiect of the sight, so is odour of the smelling; and as the sight hath the eye as his peculiar and proper instrument of seeing, so is the nose (I mean principally the parts containd within it, that is, the spongy bone and the two processes called *mamillares*) the only instrument of smelling: it were therefore very absurde to imagine that the wombe did smell saours or smells as we call them, because it is not the proper instrument of smelling, how then? It is affected with saours by reason of the subtile

Not vnder the forme of smells.

But by vapours
and spirits.

Obiection.

Solution.

Obiection.

Why muske &
ciuit cause fits
of the mother,
and stinking
things cure it.

Answer.

It is a signe of
an ill disposed
wombe to be
offended with
sweet things.

How noysome
smells cure the
suffocation.

Comparisons.

Obiection.

Answered.

The passages
of these spirits
and vapors.

Droffy water
how purged.

The working
of Tobacco in
the fingers
ends.

and thinne vapour or spirit which ariseth from any strong sented thing; euen as our spirits are refreshed and exhilarated with sweete sauours, not by apprehending the sent of them; but by receiuing a thinne ayrie vapour from them whereby the spirits are nourished, enlightened and strengthened; right so is the wombe affected with the vapors of things which yeelde a strong smell be it pleasant or vnpleasant, and that very suddenly, because it is a part of exquisite sence. But if it bee so, it may be demanded, why then the wombe is pleased with sweet smells and displeased with those that are vnpleasant? for it seemeth hereby to make choyce of smells euen for the very saueur and sent. I answer that all things which yeeld a noysome smell are vnconcocted and of a bad or imperfect mixture, and therefore they affect the sence with a kinde of inæquality; or else the spirits or vapors that arise from these ranke bodies are impure (whence come faintings and swooundings sometimes,) and so defile the spirits containd in these generatiue parts.

One difficulty there yet remayneth. If the wombe delight in sweete sauours, why then doth the smell of Amber greece, muske and such like bring suffocation of the mother; and that of *assa fetida* and *castoreum* and such like extreme stinking things cure the same disease? I answer, that all women fall not into suffocation vpon the smelling of sweet perfumes or the like, but only those whose womb is especially euilly affected. For sweet smells hauing a quicke spirit arising from them, doe instantly affect the Braine and the membranes of the same, the membranous womb is presently drawne into consent with the Brayn and moued, so as those bad vapors which before lay as it were asleepe in the ill affected wombe, are now stirred and wrought vp by the arteries or other blinde passages vnto the midriffe, the heart and the braine it selfe, and so comes the suffocation we spake of. But those things that yeeld a noysome saueur, because they are crude and ill mixt, doe stoppe the passages and pores of the braine, and do not reach vnto the inner membranes to affect them: they cure also the *Hysterical paroxisme* or fitte of the mother, because our nature being offended with them as with enemies rowseth vp it selfe against them, and together with the ill vapors excludeth also out of the wombe the euill humors from whence they arise, euen as in acute diseases nature being prouoked by the ill quality of the humors moueth to criticall excretions, or in purgations when she is goaded with the aduerse quality of the medicine relieueth her selfe by euacuation.

But you will aske by what passages are these vapors and spirits carried? I answer, beside the open passages of the Arteries by which such ayrie spirits doe continually passe, and repasse, in a mans body there are many secret and vknown waies which those subtile bodies may easily finde, considering that euen crasse and thicke humours doe ordinarily follow medicines we know not by what passages; as when a little *Elaterium* euen a graine or two will purge away three or foure pintes of water or more which lay before in the capacity of the *Abdomen*, drawing it thence into the gutts, and yet we know no direct passages from the one part to the other; and this hath made men to say that as open as the body of glasse is to the light although it be very solide, so open is the whole body as to externall aire of which we finde our body oftentimes very sensible, so to humours, much more to spirits and thinne and subtile vapors. Experience hereof we haue in the vse of Tobacco, for a man shal often finde it sensibly in his toes and fingers ends presently vpon the taking.

But of this we shall take leaue in the next discourse to speake a little more largely seeing it not onely concerneth almost all women, but may serue somewhat to stay their minds vpon many accidents which euery day befall them.

QUEST. XI.

Of the wonderfull consent betweene the wombe and almost all the parts of womens bodies.

An enumerati-
on of the parts
with which
the wombe doth
sympatize.

Concerning the wonderfull sympathy that is betweene the womb and almost all the parts of womens bodies, that place of *Hippocrates* in his Booke *de locis in homine* is most remarkable, where he sayeth, *That the wombs of women are the causes of all diseases*: that is to say, The wombe being affected there follow manifest signes of distemper in all the parts of the body, as the Brayne, the Heart, the Liuer, the Kidneyes, the Bladder, the Gutes, the Share-bones: and in all the Faculties, Animall, Vitall, and Natural;

rall: but above all, the sympathy betweene the wombe and the breastes is most notable, yet will we not sticke a little to insist vpon the former particulars.

Betweene the Brayne and the wombe there is very great consent, as well by the nerves as by the membranes of the marrow of the backe: hence in affects of the Mother come the paynes which some women often fee in the backe-parts of their head, their frenzies or franticke fittes, their dumbe silence and indeede inabilityie to speake, their strange fearefulness, sometimes loathing their liues, yet fearing beyond measure to die; their convulsions, the caligation or dimnesse of their sight, the hissing of their eares, and a world of such like and of vnlike accidents.

Betweene the heart and the wombe the consent is made by the mediation of manie notable Arteries called Spermaticall and Hypogastricall, that is, the Arteries of seede, and of the inferiour part of the lower belly. Hence come light faintings, desperate swoonings, the cessation of breathing and intermission of the pulse at least to the feeling, the vse of them both being taken away by a venemous breath, which dissolueth the naturall heate of the heart; and such women liue onely by transpiration, that is by such aer as is drawne through the pores of the skin into the Arteries & so reacheth vnto the heart: so that it is impossible almost to perceiue whether such women do yet liue or no, and doubtlesse many are buried in such fits (for they will last sometimes 24. houres or more, and the bodies grow colde and rigid like dead carcases) who would recouer if space were giuen.

In my time there went a woman begging about this Cittie, who had a Coffin carried with her, and oftentimes she fell into those Hysterical fits, and would lye so long in them, nothing differing from a dead carcas, till the wonted time of her reuiuing. Hence it may be came the Prouerbe, *Thou shalt not beleue a woman (that shee will die) no not when shee is dead,* till she be buried.

This is a sore accident, and therefore it shal not be amisse to tel you how you may know whether such haue any life left in them or no. A downy feather applyed vnto their mouth will not sometimes serue the turne, for you shal not perceiue it to shake and yet the woman liues; the onely infallible token of life or death, is if you apply a cleare looking glasse close vpon their mouths, for then if they liue the glasse will haue a little dew vpon it, if they be dead none at all. But the safest way is not to be ouer-hasty to burie women, especially such as dye suddenly and not vpon euident cause, till 2. or 3. dayes bee ouer, for some haue beene knowne so long after their supposed deaths to reuiue, and some taken agayne out of their Coffins haue beene found to haue beaten themselues vpon their reuiuing before their stifling in the graue, if we will beleue the reports of such as we haue no great reason to mistrust. But to returne to our sympathy.

Betweene the Liuer and the wombe the sympathy is a little above expressed, to which we may adde, that as from other parts affected, so from the ill affection of the wombe, sometimes come laundises, Cachexies, that is, ill habits of the bodie, green sicknesses, and (then which nothing is more ordinary) the Dropsie it selfe.

Betweene the Kidneyes and the wombe the consent is euident in the torments and pains of the Loines, which women and Maides haue in or about the time of their courses. In so much as some haue told me they had as leefe beare a childe as endure that paine; and my selfe haue seene some to my thinking by their deportment, in as great extremity in the one as in the other. This consent commeth by the mediation of the spermaticke veines, for the left of these vessels ariseth out of the emulgent or kidny vein on the same side. The like may be said of the sympathy between the wombe the bladder & the right gut, for vpon inflammation of the wombe, as Hippocrates writeth in his first Booke *de Morb. mulier.* commeth the disease of the right gut, called *Tenesmus*, that is a vaine desire to empty the belly, and also the *Strangurie*, because the inflammation presseth both parts; so that neither the excrements nor vrine can be long kept.

This consent is by reason of the vicinity or neighbourhood of the parts, as also by communion. The communion is by the membranes of the *Peritonaeum* which tie the wombe to these partes, and by their common vessels, for from the same branch of the Hypogastricall Veine come small riuers to the bladder, the wombe and the right gut. Neyther is the Connexion of the wombe with the share-bone and the Leske to be ouer passed without remembrance, which is made by two exceeding strong Ligaments, for which cause in the suffocations of the matrix, we apply Cupping-glasses to the sides of the Share-bones and to the Leske, that by these Ligaments as by certaine cords the wombe labouring vpwarde may be retracted and drawn backe.

The consent
between the
womb and
the braine.

Betweene the
heart and the
womb.

What it is to
liue by trans-
piration.

Many women
buried quick.

A Historie

How to know
whether a wo-
man be aliue
or dead.

A miserable
case.

Betweene the
Liuer and the
womb the a-
bove.
Landises.
Green sickness
Dropsies.

Betweene the
kidneyes and
the wombe.

Betweene the
bladder, the
right gut, and
the wombe.

How this con-
sent commeth

The Connex-
ion of the
womb.

Cupping glass
es applied,

The sympathy
betwene the
breasts and the
wombe.

How it is ma-
nifested.

Blood out of
the Nipples.

Milke auoided
by the wombe
and by Urine.

A strange thing
of a Maide of
Lincolnsire

The condition
of the wombe
known by the
breasts.

Hippocrates.
How to stay
immoderate
Courses

The breasts
shew the age,
sex and health
of the infant
in the wombe.
The Age.

How the
breasts foretell
the health or
sickness of the
Infant

How the ves-
sels of these
parts do com-
municate.

The common
receiued opi-
nion.

another more
likely.

But aboue all other Consents is that sympathy betwene the wombe and the breasts which exceedeth euen admiration it self, and is diuersly manifested by the frequent translation of humors out of the breasts into the wombe, and out of the wombe into the breasts; by the signes of the wombe affected which are taken from the inspection of the breasts; from the vsuall cure of the diseases of both parts; and finally from the knowledge wee haue by the breasts of the condition of the infant yet containd in the wombe. Beside the authority of *Hippocrates* in his Booke de *Glandulis*, we haue many examples of the first, that is of the translation of humors too and againe betwene these parts.

Amatus Lusitanus in his second Century the second Cure reporteth, that hee saw two women, who vpon the suppression of their courses did auoid blood out of the Nipples of their breasts at certaine and set times and returnes, imagine shortly after the vsuall time of their courses. And *Hippocrates* it appeareth had seene the like, for hee writeth in the 40. Aphorisme of the fift section, that those women who haue blood gathered about their breasts are in danger to grow mad and raging. *Brassauolus* reporteth, that hee saw a woman out of whose breasts issued blood in stead of milke; and this may well be, for we all know that Nurses haue their courses stopped, because the blood returneth from the wombe vnto the breasts, where it is turned into milke vsuall; that in this example the blood came out vnturned was the rarity. We haue seene also on the contrary many women in childebed who haue auoided by the wombe and the bladder great quantities of milke. This translation of humors therefore is ordinary. Sometimes the blood goeth other wayes, as I haue knowne an ancient maide in Lincolnsire, who euer about the time she should haue her Courses, for many daies together hath found in her mouth in the morning when shee awaked, the quantity of three or foure ounce of blood more or lesse, and most part of it caked as it is in a Sawcer after blood-letting, and this continued with her for many yeares together, but hir teeth rotted fowly with it, her breath grew noisome, and shee faint at those times, but without any other disease.

For the second, that is, that by the inspection of the breasts the condition of the wombe may be knowne, we will alledge onely that oracle of *Hippocrates* in the sixt Booke of his *Epideemia* and the fift section. If the Nipples of the breast and that which is vsuall red about them, grow pallid or yellowish, then is the wombe diseased.

For the third, that the cure of the affectes of these parts demonstrate their sympathie, we may remember that which *Hippocrates* hath deliuered, and is continually put in practise as neede requireth, viz; *If you would stay the immoderate fluxe of a womans Courses, then set a great Cupping-glasse vnder her breast; for that will draw backe the blood by an accustomed way.*

Finally, by the inspection of the breasts, the age, the sexe, and the health of the Infant yet in the wombe is demonstrated. *Hippocrates* in his Booke de *Natura pueri*: *As soone as the infant beginneth to moue, the Milke acquainteth the Mother with it, for presently vpon the motion the breasts swell, and the Nipples strut out.* If therefore the breasts bewray the time of the infants mouing then doe they also declare the age; for a man childe moueth the thirde month, a maiden childe the fourth. And for the sexe, *If the right breast, saith Hippocrates in the 38. Aphorisme of the fift Section, doe consume or fall, it fore-tokeneth an abortment of a male childe; if the left, of a female; so if the right breast swell and strut it is a signe that a male childe is conceived, if the left a female.*

Last of all, the inspection of the breasts doth foretel the health or sicknesse of the infant. For if in a woman with childe the breasts do suddenly fall swampe as we say, then will shee abort ort miscarry, so saith *Hippocrates* in the 37. Aphorisme of the fift section. All these are most euident and necessary arguments of the consent and sympathy between the breasts and the wombe: but because almost all simple sympathies are made by the communion of vessels, we will in a few wordes lay open vnto you how the vesselles of the two partes doe communicate one with another, as *Laurentius* conceyueth it.

Almost all Anatomistes do agree, that the branches of the ascending Epigastrick veine, do meete in one with the branches of the descending Mammariæ veine; and that there are in these branches many Anastomoses or inoculations. I doe not deny (saith *Laurentius*) the coition or coniunction of these branches, but seeme to my selfe to haue found more patent large, and nigher wayes for this communion. For the Epigastricke veine is not disperfed in his branches through the wombe, but ariseth more commonly from a branch of the Cru- rall veine.

Lik-

Likewise that veine which they call *Mammaria* or the brest veine, runneth by the inner part of the brest-bone to nourish the Triangular Muscle, neither doth it send any branches to the brests vnlesse they be very smal and threddy. I suppose therefore (saith he) that blood, milke and other humours doe flowe backe by the Hypogastricke and spermaticall Veynes (which are proper veines of the wombe) vnto the trunk of the hollow veine, and out of it into the vein called *Axillaris* or the shoulder vein, from which there arise two notable chest veines called *Thoracicae*, which do water the Muscles of the chest, and the Glandules or kernels of the brest.

The Mammaria Veine.

The Hypogastrick & spermaticall Veynes.

On the other side, I conceiue that the milke returneth by the *Thoracicall* veines to the *Axillarie*, from it vnto the trunk of the hollow veine: from which it passeth sometimes by the spermaticke branch into the wombe; sometimes by the *Hypogastricall* partly into the wombe partly into the bladder; from whence come oftentimes those milky waters which wee call *Lactea*, that are made after the woman is deliuered. There is also a nearer way for the milke to passe by the wayes of the vrine through the emulgent veines.

Milky waters made after womens labour.

QUEST. XII.

Concerning the Acetabula, the hornes and coates of the wombe.

Concerning the endings of the vessels in the bottome of the wombe, to which the after-birth cleaueth till it be seuered either by the strength of the Infant, or after by the dexterity of the Midwife, they are called *Acetabula* in Latine; in Greeke *Coryledones*, which are nothing else but the ioyning of the endes of two paire of veines (one comming from the spermaticall another from the *Hypogastricall* branch) with the mouths of the vmbilicall veine; and so making a symphysis or connexion between the mother and the Infant.

Coryledones what they are.

The latter Anatomists deny that there are any such conspicuous in women, but onely in Sheep and Goates: *Aristotle* sayth (in his 3. Book of the *Historie* and the second of the *Generation of Creatures*) they are onely to be found in horned Beasts: we say, There is a 3. fould acceptation of this word *Acetabula* in *Galen*s Book of the dissection of the wombe. First they signifie visible holes into which the vessels of the wombe doe end in fashion resembling the hearbe called Venus Nauil, which we call in English Penny-grasse or hippewort. These *Acetabula* are neuer found in women but in Sheep & Goates are very conspicuous. Secondly by *Acetabula* we vnderstand the mouthes of the vessels swelling like Nipples. And lastly, they are the ends of the vessels at the bottome of the wombe ioyning with the vmbilicall or Nauill veines. In this third acceptation no man will deny but that they are to be found in the wombe of a woman.

In what Creatures they are found.

What *Galen* meaneth by *Acetabula*.

How they are to be found in women.

These mouthes of the vessels sayeth *Hippocrates* in the 45. Aphorisme of the fifth Section, if they be full of mucous or slimy water are the cause of abortment, because it dissolueth the continuity or connexion of the Infant with the wombe.

A cause of abortion.

Concerning the hornes of the wombe which bud out at the sides thereof, *Diocles* first of all men made mention of them. *Galen* and almost all Anatomists following him do confesse them to be in the wombe of a woman; but the truth is, that they are only conspicuous in Sheep, Goates, and Kine. Indeepe the sides of a womans wombe doe swell a little and are rayed where the leading vessels doe end, but not sufficiently to expresse the forme of horns or Nipples.

Of the hornes of the wombe.

Lastly, *Galen* seemeth to speake diuersly concerning the coates of the wombe, sometimes affirming it hath but one, as in the third Booke of *Naturall faculties*; againe in his Booke of the dissection of the wombe he sayeth it hath two; the outward peritoneous, the inward venal; the outward simple, the inward double; but these places may easily be accorded: for whereas he sayeth it hath but one, he vnderstandeth the proper coate of the wombe which is the thickest of all the coates of the body; but when he sayeth it hath two, he addeth to the proper a common coate comming from the *Peritoneum* or Rim of the Belly.

Of the coates of the wombe.

Galen reconciled to himselfe.

QVART. XIII.

Of the Membrane called Hymen, and the markes of virginity.

What the Hy-
men is thought
by some to be.



The locke of
virginity.
A custome a-
mong the
Iewes.

Laurentius his
opinion.

Imperforata
mulieres.

Actus. 4. cap. 28.
Paul. lib. 6.
cap. 73.
Celsus lib. 7.
cap. 28.
Albucasis lib. 2.
Oribasius lib. 2.
medic. lib. 2.

It hath beene an old question and so continueth to this day, whether there be any certaine markes or notes of virginity in women and what they are. Almost all Physitians thinke that there is a certain membrane sometimes in the midst of the necke of the wombe, sometimes immediately after the passage of the water, placed ouerthwart, which they call *Hymen*. This membrane they say is perforated in the midst to giue way to their cour-
les, and is broken or torne in their first accompanying with men, and therefore they call it *Clausum virginis*, *The locke of virginity*: for which their opinion they bring testimonies out of the holy scriptures. For it was a custome among the Iewes that the Brides should not accompany with their Bridegroomes but vpon a sheete, wherein the blood should bee kept, which was giuen to the Brides parents as a witnesse of their daughters true virginity. *Falopius* yeeldeth to this opinion, *Columbus* writeth that he hath seene it, *Laurentius* sayeth that he hath cut vp mayden children borne before their time, of three moneths, of 3, 4, 6. and 7. yeares old, and yet hee could neuer finde it though he searched curiously for it with a Probe; which (saith he) might haue beene felt to resist the Probe if there had beene any such thing, and therefore he thinketh that it is but a meere fable. Yet notwithstanding thus far he giueth credite to *Columbus* and *Falopius*, that hee thinketh there is sometimes such a membrane found, but if it be stretched ouerthwart in the middle or at the end of the necke of the wombe, then hee thinketh it is not Naturall, but an Organically diseased or of the in-
firmment being faulty in conformation. So oftentimes at the very end or extremity of the
lap there groweth sometimes a membrane sometimes a Caruncle or small peece of flesh, which affection or disease *Auicenna* calleth *clausum* or *the inclosure*; the Grecians call it *Quaritis* and such women *aphtas*, that is *imperforatas*. Some are so from their infancie, some by mishap, as by an ylcere, inflammation or some other tumor against nature; but hee that will reade more of this disease let him resort to *Actius*, *Paulus*, *Celsus*, *Albucasis* and *Oribasius*, who thinketh that there is at all no such matter. Wee must therefore finde out some other locke of Virginity. Some thinke the sides of the necke of the wombe do cleaue together in mayds and in the deuirgination are separated. *Almanzor* writeth that the necke of the wombe in virgins is very narrow and rugous, & those foulds or plights are wouen together with many small veines and arteries which are broken in the first coition. *Laurentius* is of opinion that those foure Caruncles described in the history of the wombe and placed not ouerthwart but longwise, doe so ioine together in virgins by the interuening of exceeding thin membranes, that in the first coition both the Caruncles are fretted and the mem-
branes torne, and that thence floweth the blood. This ioyning of the Caruncles *Senerinus*
Pineus a learned Chyrurgion belonging to the French King, hath notably described in a Booke which hee wrote of purpose concerning the markes or notes of Virginity, which wee also remembered before in our discourse. And thus much
shall suffice to haue spoken concerning the parts of Gene-
ration both in men and women, and the
Controuersies thereto
belonging.

Honi soit quemal y pense.

The end of the Controuersies of the Fourth Booke.

THE FIFT BOOKE,

Wherein the Historie of the Infant is accurately described, as also the principles of Generation, the Conception, the Conformation, the Nourishment, the Life, the Motion, and the Birth of the Infant, as neere as may be according to the Opinion of Hippocrates.

The Preface.



Inding this following discourse of the forming of the Infant in *Laurentius* immediately following his Historie of the parts of Generation, and considering that it contained many things not only profitable but pleasant also, I thought good (gentle Reader) to make thee partaker thereof. And the rather I heereto perswaded my selfe, because at the first sight I conceiued that my selfe also in this *my conception* should find pleasure. But it hapneth all otherwise with me then it is in naturall generation, where the infant is begotten in pleasure, though brought forth in paine. For this I assure thee was begotten with much paine and trauel, & if thy gentle hand help not in the birth, that also will be very irksome. I know I shalbe taxed by some for hanging too long in this argument, but I also know that al the authority blame hath, is from the Authors therof. The subiect of our present discourse is the history of the Infant, of the Principles of his generation, his Conception, Conformation, Nourishment, Life, Motion and Birth. Verilie a knotty & snarled skaine to vnreele; a thicket, wherein he that hasteth with bold rashnesse and temerity shall offend & stumble at euery step; he that is diligent shall entangle himself, and he that is guided by blinde ignorance shall light vpon pits and bogs, so that it will bee impossible for any man that enters into these Lifest fairely to acquite himselfe. The further he wadeth in this Riuer, the greater confluence of waters wil ouertake him, the deeper must he sound if he will finde the bottome.

We begin with the seed which is like the *Chaos*. Vpon which as the Spirit of God moued whilst it was without forme; first to preserue it & after to distinguish it, so it is in this masse of seed; the Formatiue spirit broodeth it first. After as a Spider in the center of her Lawny Canopy with admirable skil weaueth her Cipresse web, first hanging it by slender Tiesto the rooffe, and after knitting her enter braided yarn into a curious net: so the spirit first fastneth the seed to the womb with membranes and ligaments, after distinguisheth it into certaine spermatieall threds which we call *Stamina corporis*, the warpe of the bodie. To these when the second principle which is the Mothers blood accrueth, it fileth vp their voyde distances and so amasseeth them into a solid body, whicheuery day is nourished and encreased into all dimensions, furnished also with motion, sense and finally with a reasonable soule. Then as impatient of so close imprisonment, as vnstatisfied with so slender allowance, it instantly striues till this Little world arriues into the great.

After we haue thus perfected the History, we descend vnto the many and busie Controversies depending thereupon. These concerne the differences of the sexes, the Nature of the Seed with the manner of his excretion; the qualities of the Mothers blood, the accidents hapning vnto vs therefrom, with the causes of the monthly euacuation of the same; the manner of Concoction as well lawfull, both simple, double and manifold, as illegitimate and monstrous; the order and times of Conformation, not onely of the infant it selfe, but also of the membranes and vessels to which it is fastned; the Similitude of the children to theyr parents; the admirable effects of the Imagination; the causes of superfoeration; the manner and matter of the infants Nourishment; the admirable Vnion and communion of the vessels of the hart; how he breatheth by Transpiration, not by Respiration; the works of his Vitall and Animall spirits; his Scituation or position in the wombe; and finally, the nature, differences, times and causes of Birth, together with the consequences thereof. All these with many more falling in with our disputations we heere exhibit for their satisfaction whom they may concerne, and who are more desirous to know them, then able of themselves to attaine therero.

CHAP.

The argument of the Booke following.

The manner of the Infants production out of the seed

The Controversies contained in this Booke.

CHAP. I.

What things are necessary toward a perfect Generation.

The propaga-
tion of kindes
diuerse.

Insecta Anima-
lia.

D. Muffet.

Three things
required to
perfect gene-
ration.

1. Distinction
of sexes.

A barbarous
conceit.

2. Copulation

3. Emission of
seede.

Two princi-
ples of gene-
ration.

THe propagation of kindes, as it is made in the Elements by Transmutation, and in Metals by Apposition, so it is in creatures by generation. But of Generation there are diuers manners. For some creatures engender without coition onely by affrication: Others quite contrary to the ordinarie course of Nature, by a reception of the instrument of the female. Some females also do engender within themselves without the helpe of the male. There are also some creatures which are engendered onely by putrifaction without either male or female: others are sometimes bred out of putrifaction, otherwhiles out of seede. But all these kinds of generation are maimed and imperfect, and therefore the creatures so procreated, are called *ἀναιμα, πολυύβρια καὶ ἐντρομα*, *ζῷα* vnbloody and insectile creatures, of which a man of worthy memory among vs, D. Muffet hath written a learned and curious discourse, which happely time may communicate vnto the world. The Generation of man and of the perfect creatures is farre more noble, as whereto three things are alwaies required; a diuersity or distinction of sexes, their mutuall embracements and copulations, and a permixtion of a certaine matter yssuing from them both which potentially containeth the *Idea* or forme of the particular parts of the body, and the fatall destiny of the same, and this the Grecians call *μετὰ τὴν περὶ τὴν φύσιν*.

The distinction of the Sexes is especially necessary, because Generation is not accomplished but by seeds which must be sowne in a fruitfull ground, that is, shedde into such a place as wherein their dull and sleepy faculties may be raised and rowzed vp, which we call Conception, and afterward that which is thus conceived, may be cherished, nourished, and so attaine the utmost perfection of his kinde. But because man was too hotte to performe this office (for his heate consumeth all in him and leaueth no remainder to serue for the nourishment of the infanc) it was necessary that a woman should be created (for wee will insist now onely in mankind) which might afford not onely a place wherein to cherish and conceive the seede, but also matter for the nourishment and augmentation of the same. Both these sexes of male and female doe not differ in the kinde as we call it or *species*, that is, in the essentiall forme and perfection; but onely in some accidents, to wit, in temper and in the structure and scituation of the parts of Generation. For the female sexe as well as the male is a perfection of mankind: some there bee that call a woman *Animal occasionatum*, or *Accessorium*, barbarous words to expresse a barbarous conceit; as if they should say, A Creature by the way, or made by mischance; yea some haue growne to that impudencie, that they haue denied a woman to haue a soule as man hath. The truth is, that as the soule of a woman is the same diuine nature with a mans, so is her body a necessary being, a *first* and not a second *intention of Nature*, her proper and absolute worke not her error or preuication. The difference is by the Ancients in few words elegantly set downe when they define a man, to be a creature begetting in another, a woman a Creature begetting in her self.

The second thing required to perfect generation, is the mutuall embracements of these two sexes which is called *Coitus* or coition, that is, going together, A principle of Nature whereof nothing but sinne makes vs ashamed. Neither are these embracements sufficient, vnlesse from either sexe there proceed a third thing, by which and out of which a new man may bee generated. The effusion therefore of seeds (which are indeede the immediate principles of generation) is altogether necessary, otherwise it were not a generation, but a new Creation. These three things therefore must concur to a perfect generation, a distinction of sexes, copulation, and an emission of seede from them both.

CHAP. II.

Of the Principles of generation, seede and the Mothers blood.



Hatsoeuer is generated (saith the Philosopher) is begotten out of somewhat and from somewhat; else were it as we said a new Creation no Generation; Wherefore the Ancients haue resolved that two principles must concur to generation, Seed and the Mothers blood. The seed is the principle à quo, that is, the effi-

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cient or workman which formeth the Creature, and *ex quo*, that is, the matter whereof the spermaticall parts are generated. The blood hath onely the Nature of a matter and passiue principle, (we therefore vse the Schoole words because they most emphatically expresse the thing) for out of this blood the fleshy partes are generated and both the spermaticall and the fleshy are nourished. The Nature of both these principles is very obscure, which we will endeavour to make plaine on this manner. The Seed is called in Greek *σπέρμα*, *σπέρμα*, in Latine *semen*, *Genitura*, betweene which *Aristotle* puts a nice differenc, but *Hippocrates* takes them promiscuously for the same. And so we will call it Seede and Geniture, which we define: A body moyst, hot, frothy and white, consisting of the remainders of the least and perfect nourishment and the spirits mingled therewith, laboured and boyled by the vertue of the Testicles, and so made fit for the perfect generation of a living Creature. This definition doth fully and sufficiently expresse all the causes, the formall, the materiall, the efficient and the finall.

A perfect definition of seed.

The humidity, heate, frothinesse and whiteness do make the forme. The seede is moist *δυσκρετὸν & οὐκ ὄν*, that is in Power and Consistence; and therefore *Ctesias* Physician to King *Artaxerxes* was deceived, who thought that the seed of an Elephant was so dry that it would become like unto Amber; but it is necessary it should be moyst, as well that it might be moulded by the efficient, as also because it must containe the *Idea* or specificall forme of all the particules. Hot it is, that it might produce those formes, for cold entrencheth not into generation vnlesse it be by accident. It is frothy by the permixtion of the spirits and by their motion; whence it is that the Poets call *Venus* *ἀσπότης* as if shee were made of the froth or foame of the sea; and therefore seede when it is auoyded soone loseth his magnitude, because the spirits which hould it vp do vanish; whereas phlegme and other mucous matters keepe their bulke because they haue little spirits in them. It is white, because it is boyled in the Testicles and the spermaticall vessels whose inward superficies is white, as also because it containeth in it much ayre and spirits: and therefore it is but a vaine thing which *Herodotus* reporteth of the seed of *Negroes* or *Blacke-Moors*, that it is black.

The formall cause. *Ctesias* his error.

How moyst.

Why hot.

Why frothy.

The matter of the seed is double, the ouerplus of the last nourishment and spirits. That ouerplus is blood, not altered and whitened in the solid parts as the Ancients imagined, but red, pure and sincere, deriued to the Testicles and the preparing vessels from the trunk of the hollow veine through the spermaticall veines. And hence it is that those men who are very immoderate in the vse of *Venus*, auoyde sometimes bloody seede, yea now and then pure blood. Of this minde also is *Soranus* and therefore it is, sayeth he, that the Ancients called those that were of a kindred *Consanguineos*. i. of the same blood, because the seede is made of blood, which phrase we also at this day retayne. The other matter of the seede is that which maketh it fruitfull; to wit, those Spirits which wander about the body; these potentially containe the *Idea* or forme of the particular parts (for they are ayrie and moyst easily taking any impression) and passe through the spermaticall arteries to the mazey vessels of the *Parastata* and the Testicles. There they are exquisitly mingled with the blood, and oftwo is made one body, like as of that admirable complication of the spermaticall veine and arterie is made one vessell.

The materiall cause double. Blood.

Soranus. Why kinsmen are called *consanguineos*.

And spirits.

This double matter of the seede *Hippocrates* expresseth by the names of fire and water, for so he sayth sometimes, that the seede is fire, sometimes he calleth it water. It is fire by reason of the spirits which haue in them an impetuous violence or nimble agility, whence also it is called *σπέρμα δεικνύμενον* *sementurgens*, swelling seede. In respect of the blood which is the corpulency or bulke thereof, it is called *αἰματώδες* watery. Both these *Hippocrates* in his Booke *de diata* in one sentence elegantly expresseth, where he sayth, *The Soule crepeth into man being made of a mixture of fire and water*: By the Soule he meaneth the Seed, which therefore in other places he calleth *ἐν-ζυγον*, that is Animated: by Fire hee meaneth the spirits and the in-bred heat which is commonly called *innatum calidum*; by Water hee meaneth the Alimentary moysture which is blood. The fire sayeth hee moueth all things through and through, the water nourisheth all things through and through. In respect therefore of this double matter the seede carrieth the nature of both the principles of generation; of the materiall in respect of his crassament or thicke body out of which as out of their proportionable matter the spermaticall parts are generated; of the efficient and of the forme in respect of the spirits wherewith it is fulfilled. I sayed that the seed was called an efficient and formall principle, because the efficient and the forme are two actors in respect of their different operations, though in deede and trueth they are but one and the same. For the forme

Hippocrates. How seed is fire. How watry.

A hard place of *Hippocrates* explained.

How seed is both an efficient and materiall cause.

forme being diffused through the matter, maketh it to be that which it is and no other thing, & it is called *εἶδος*, the species, or *εντελεχεια* the act: but consider it as it affecteth, moueth, disposeth and worketh the matter into a proper and conuenient habitation for it selfe, and then it carrieth the nature of an efficient. The seede in respect of his body yssueth only from the vessels; but in respect of his spirits which wander vp and downe and through all, it may be sayde to yssue from all the parts of the body. This therefore is the double matter of the seede, blood and spirits.

The efficient
cause of the
seede.

The Efficients and authors of the seede are onely the Testicles, for the power called *σπέρμα*, that is, of *makeinde seede*, we attribute first of all and originally to the testicles: To the spermatieall vessels secondarily *per ἀπὸρροήν* that is, by influence and irradiation from the testicles.

The finall
cause.

The last part of the definition designeth the finall cause of the seede, to wit, the generation of a liuing creature, and the nourishment of the testicles. And thus it appeareth how this definition of seede is accomplished euery way and compleate.

Seed of two
sorts,
Of the Male.

Furthermore, seede is of two sorts whatsoever the *Peripateticks* prattle to the contrary, one of the male, another of the female; because in both sexes there are by Nature ordained Organs or instruments for the preparing, boyling and leading thereof; as also the same causes of pleasure and delight in the spending or euacuation. But yet the seede of the male is the first principle of generation and more actiue or operative; the Females the second and lesse operative, yet they are both fruitfull and powerfull for procreation, but neyther of them auailable without the helpe of the other.

The Female.

Two kinds of
seeds in both
sexes.

Hippocrates in his first Book *de Diata* maketh mention of a double kind of seed in both sexes, the one strong & hot, the other weaker and colder. The first he calleth *semen masculū* or male seede, the other *semen femininum*, or female and foemine seede: out of the diuers mixture whereof, and as they overcome one another, hee thinketh that a male or foemale creature is generated. And thus much for the first principle of Generation, which is Seede.

CHAP. III.

Of the Mothers Blood, the other principle of Generation.

What parts
are made of
this blood.

Menstruall
purgations.

A definition
of the courses.

H He other principle of our generation is the Mothers blood, to which we ascribe the Faculty of suffering onely, and not of dooing, that is to say, it is onely a principle which is wrought vpon by seed, but it selfe worketh not in the generation of man.

Of this blood are the *Parenchymata* of the bowels made, as also the flesh of the Muscles; with this as wel the spermatieall as the fleshy parts are nourished, doe encrease and attaine their seuerall perfections. This blood wee thinke is of the same nature with that which at certaine times euery moneth is purged out by the wombe, in which respect *Hippocrates* first called it *καταμήνιος αἷμα*, that is, the Menstruous or monthly blood. The Nature of this blood entangled in a thousand difficulties we will make plaine by this definition. The Menstruous blood is the excrement of the last Aliment of the fleshy parts, which at certaine times and by standing periods is in a moderate quantity purged by the wombe, but originally ordained for the Generation and Nourishment of the New creature. This definition expresseth six heads concerning the menstruall blood: the matter, the Efficient cause, the vniuersall time, the particular time, the quantity, the wayes of euacuation, and the vse which hath the nature of the finall cause.

The matter of the menstruous blood is the ouer-plus of the last Aliment. For in the nature of women there is a superfluity more then she spendeth for many reasons. First, because their heate is but weake, and cannot discusse or evaporate the reliques leste after the parts are satisfied; secondly because of the softnesse and loosenesse of their flesh; whence it is that a womans body is scarcely perspirable, that is, in respect of men they sweate but little. Thirdly, by reason of their course of life and order of diet. For they eate more moist meates, they vse bathing oftner, they sleepe more, and in a word their life is more sedentary and idle, at least they vse lesse exercise; for these reasons a woman among all creatures is followed with these monthly euacuations.

We call the matter of this blood an Excrement, not that it cannot bee assimilated or is of a hurtfull or noxious quality like an vnprofitable excrement, but because the quantity thereof redoundeth after the flesh of the parts is satiated and filled, and is returned into the veines and thence as an excrement discharged by Nature offended with an vnprofitable bur-

burthen, for there is a satierie euen of that which is good. And this is that affluence and refluxence *Hippocrates* speaketh of, that Tide of the blood sometimes flowing, again ebbing sometimes. For when the veines strut with fulnesse the hot flesh draweth the blood vnto it, which, when that attraction is satisfied and ceased, ebbeth againe into the veines. This blood therefore is laudable and Alimentary, and as *Hippocrates* writeth in his first Booke *de morbis mulierum*, floweth out red like the blood of sacrifice and soone taketh if the women be found.

Hippocrates is
pounded.

The veines being fulfilled with these remaynders of the Aliment, and burnd with the wayght of the blood whose quantity onely is offensive vnto them, they sollicit Nature to excretion. Nature, being alwayes vigilant for her own behoofe, and a true louer and cherisher of her selfe, by the expelling faculty which she hath alwayes at her command driueth out these reliques. For as a man that hath lost one or both his legges, if hee continue that fulnesse of dyer which hee vsed before, is often sollicit with a great issue of blood by the sledge, because the liuer sanguifieth as much as it was wont, which yet there wants one part or more to consume it: euen so and after no other manner is this menstruall euacuation accomplished by Nature, not being able to dispose of that plenty which by the Liuer is ministered vnto her.

The efficient
cause of the
courses.

But because Nature doth all her businesses in order and therefore prescribeth lawes vnto her selfe, she doth not indeuour this excretion in euery age, at all times, nor euery day, but at set times and by determined periods, which she of her selfe neither anticipateth nor procrastinateth; that is, doth not either preuent or foreflow vnlesse shee be prouoked and hastened before her time, or else hindered or interrupted at her owne time. These Naturall times are either vniuersall or particular. The Vniuersall time, all men do accord, beginneth for the most part in the end of the second seuen yeares, that is, at 14. yeares olde, and endeth the seauenth seuen, that is at 49. or 50. Now the reason why this blood floweth not before the 14. yeare is, because both the vessels are narrower, and beside the heate overcome with the aboundance of humour, cannot expel the reliques, which after it hath gotten more strength it is able to maister and driue as it were out of the field. Adde hereto that in the first 14. yeares a great part of the blood is consumed in the growth of the body; and beside, yea especially before the woman be fit to conceiue, Nature doth not bestow this matter of the menstruall blood vpon her.

The vniuersall
times of the
courses and
the reasons
thereof.

Now at the end of the second seauen yeares the heate begins to gather strength, to burst forth as the Sunne in his brightnes, and to rule in the Horizon of the body; from which heat doe proceede as necessary consequences, the largenes of the wayes and vessels, the motions and commotions of the humors, their subtilty or thinnesse, and finally the strength of the expelling faculty. At that time men begin to grow hayrie, to haue lustfull imaginations and to change their voyce; womens Pappes begin to swell and they to thinke vpon husbands. After the fiftieth yeare the courses cease, because the heate being now become more weake is not able to engender any notable surpluse of laudable blood, neither yet if there be any such ouerplus, is it able to euacuate or expell the same; you may adde also and especially, that Natures intention and power of procreation beeing determined; it is no more necessary that there should be any nourishment set aside for an Infant.

Why the courses
flow at 14.
yeares old.

Why they stay
at 50.

Concerning the particular times of this monthly euacuation, *Aristotle* is of opinion that it cannot be precisely set down, and almost all learned men herein consent with him. Notwithstanding it is reasonable, we say, to thinke that Nature hath set and determinate motions and established lawes, albeit wee are ignorant of them: for who was euer so neare of Natures counsel but that he might in some things erre, in somethings be to seek? These times known to her selfe she kepeth immutable and inviolate, vnlesse either the narrownes of the wayes or the thicknes of the humour doe interrupt her, or else shee bee prouoked by the acrimony of a corroding quality in the blood, or by some other outward prouocation to poure them forth before her owne stinted and limited time. Once therefore euery moneth shee endeouoreth at least, this menstruall excretion; sometimes in the full of the Moone, sometimes in the waine; and in those women we call *viragines*, that is, who are more mannish, for three dayes together, in others that are more soft, idle and delicate, (such as *Hippocrates* in his first Booke *de dieta* calleth *idolodas*, that is, waterish women) for a whole seuen-night. And againe, in the first Section of his sixt Booke *Epidem. In women that are waterish the courses continue longer.* In those women that are of a middle and meane disposition they continue foure dayes; and these we call Particular times.

The particular
times of the
courses.
Aristotle.

The

Hippocrates.

The quantity of this monthly euacuation cannot be defined. For as *Hippocrates* obserueth in his Booke *de natura muliebri*, the blood issueth more freely or more sparingly according to the variety of their colour, temperament, age, habite and the time of the yeare. Those women which are fayre and white haue such aboundance of humour, that it issueth diuerse wayes; contrary to those are browne and swart skins who are commonly drier. In moderate and meane tempered women the quantity of the courses is about two *Hemina*, that is 18. ounces which is *Hippocrates* his proportion.

The wayes of the courses.

The wayes ordayned for this euacuation are the veines of the wombe and the wombe it selfe. The veines do run from the *Hypogastricke* and spermatick branches to the bottome and necke of the wombe; by the veines of the necke of the wombe it issueth in those women which are with child, by the other in virgins and such as are not conceiued, but not *per diapedosim*, that is, by transudation, but *per anastomosim*, that is, by the opening of the orificies of large and patent veines.

Why nature purgeth the blood through the wombe.

Now if it be asked why the blood is purged through the womb; I answer, it is done by a wonderfull prouidence of Nature, that the blood being accustomed to make his iourney this way, it might after conception presently accrew for the nourishment and generation of the Infant.

The final cause of the menstruous blood double.

Hence we gather the finall cause of the menstruous blood (which was the last poynt in our definition) to be double, the generation of the *parenchymata* or substances of the bowels and the flesh, as also the nourishment and sustentation of the Infant as well whilest it is in the mothers wombe, as also after it is borne into the world. For how should the seede conceiued attaine either nourishment or increase vnlesse this blood should be disposed into those wayes wherein the Infant is conceiued? Afterward when it is borne, the same blood returneth by knowne and accustomed waies also into the pappes and there is whitened into milke to suckle it. And this we take to be the nature of the second principle of our generation, the mothers blood or the monthly courses.

CHAP. III.

Of Conception.

The order of the acceffe of the principles.



Hese two principles of Generation, Seede and the Mothers blood are not at one and the same time auoyded in coition, because the spermatick and the fleshy parts are not at one and the same time delineated. But if the generation goe rightly on, first both sexes doe affoord fruitfull and pure seedes which are poured out into the wombe as it were into a fertil field. Afterward when the filaments or threds of the solide parts are lined out, then the blood floweth thereto as well for structure of the *parenchymata* or substances of the bowels, as also for the nourishment of the whole embryo or little Infant.

Hippocrates expounded.

The man therefore and the woman ioyned together in holy wedlocke, and desirous to raise a posterity for the honour of God and propagation of their family; in their mutuall imbracements doe either of them yeeld seede, the mans leaping with greater violence. The woman at the same instant doth not onely eiaculate seede into her selfe, but also her womb snatcheth as it were and catcheth the seede of the man, and hideth it in the bottom and bottom thereof.

Conception what it is.

These seedes thus cast and drawn into the bottome of the womb are out of hand exquisitely mingled, otherwise sayeth *Hippocrates* in his Booke *de Natura pueri*, they are neither *nourished* nor *animated* together. And if any man, sayeth he in his first Booke *de diata*, do deny that the Soule is mixed with the Soule, let him be held for a dotard. Now by the Soule hee meaneth the Seed, as we haue sayed before. This mingling of the seeds is the first worke or endeavour of Nature in generation. And presently after the seeds are thus mingled, the womb, which is the most noble and almost diuine Nurse, gathereth and contracteth it selfe, and that I may vse the words of the Arabians, is so corrugated that there is no empty or void place left therein. And this it doth as being greedy to conteyne and to cherish, we say to Conceiue the feed. Moreouer, least the geniture thus layd vp should issue forth againe; the mouth or orifice of the wombe is so exquisitely shut and locked vp that it will not admit the poynt of a needle. Then the wombe rowzeth and raiseth vpp the sleepey and lurking power

power of the seeds, and that which was before but potentiall, it bringeth into act. This action of the wombe we properly call *Conception*, the Grecians *κίνησις* or *κίνησις*, and it is a Vi-
An action of the wombe.

Hippocrates in his Booke *de Principijs*, and the fift Aphorif. hath left vnto vs some signes of Conception. Some also doe gather signes of Conception out of all the parts almost of the body. We thinke a woman hath conceived, if in the confluence of their seedes there runneth a chilnesse or light horror through her whole body; or if she perceiue her wombe to contract it selfe; if she receiue the seede of man with delight, and it yssue not from her againe; if the inner mouth of the womb be exquisitely and perfectly shut; if she haue a light and wandering paine about her Nauell or *Hypogastrium*, which we call the Water course; if her monthly courses do stop vnusually; if her Paps grow hard, do swell and haue paine in them; if she be not so fit for, or desirous of *Venus* combats; if she suddenly grow mery and as suddenly againe sad beyond her accustomed manner; finally, if shee haue a loathing of her meate, and vse to cast in the morning after her bodye is a little stirred. But whether a woman be conceived with a man or a woman childe it is very hard to iudge. Notwithstanding, we may thus make coniecture out of *Hippocrates* in the 48. Aphorisme of the 5. Section. She that goeth with a manchild is well coloured, she that goeth with a woman child is swarthy or pale coloured. Againe in the same place, Male children are borne in the right side, Females in the left; and in the 38. Aphorisme of the same Section. If she haue conceived a male the right pap will swell, if a female the left: but all these signes are rather coniecturali then carry any certainty with them.

The signes of Conception.

Of a man and of a woman child.

CHAP. V.

Of the Conformation of the Parts.

HHe Generatiue faculty which before lay steeped, drowlie, and as it were intercepted in the seede, being now raised vp by heat and inbred propriety of the wombe brea-eth out into acte, as raked Cinders into a luculent flame. Then that noble and diuine builder setteth vpon her worke, and buildeth her selfe a habitation fit for the exercise and performance of all hir functions. But because shee could not performe this so great a worke without an organ or Instrument, she vseth the spirit (wherewith the froathy seede swelleth) as hir Painter or drawer to score out and delineate all the particular parts. This spirit walketh through the whole body of the seede, and diffuseth it selfe into euery part and portion thereof. This spirit is he which maketh the parts Homogenie, that is, gathereth all the particles of a kinde together, extendeth them, and as a glasse maker holloweth or boreth them by blowing into them. To this spirit *Aristotle* imputeth the Ordination, the Segregation, the Concretion, the Denfation, Rarefaction and Contraction of the matter of the parts. This *Galen* in his second Booke *de Semine*, calleth the framing Artizan, the begetter or the former of the parts of man. And *Mercurius Trismegistus* saide well, that it was the spirit which viuifieth or quickneth euery forme in the whole world, dispensing and governing all things according to the proper worth of each patticular.

The spirit is the workman.

Aristotle.

Mer. Trismegistus.

The spirit therefore is the first and immediate instrument of the soule, disporting it selfe in the bulke of the seede, and like a cunning Painter shadding out first with a rude Penfill the conformation of al parts both Similar and Organicall, the forme and Idea whereof it containeth in it selfe; afterward it addeth the lively colours, beautifying and polishing euery one in their due order.

This whole worke of conformation that admirable *Hippocrates* as *Galen* witnesseth in his first Booke *de Semine*, distinguisheth into foure times. The first time is that, wherein the seeds mingled doe yet retaine their owne forme which he calleth *γόνιμ*, for then there is nothing to be seene but the seed coagulated or sammed together, and couered as it were with a filme. The second time he calleth *κίνησις*, wherein there is a certaine rude adumbration of the parts, and as it were a fleshy masse. The third, wherein a man may see the representation of the three principall parts, the Braine, the Heart and the liuer, together with the first threads and as it were the warp of all the spermatieall parts, and this constitution of the creature he calleth *ὑπόμνησις*. The fourth and last time wherein there is a perfect separation,

The Conformation diuided into foure times.

discretion and description of all the parts, and then he calleth it *παῖς ὅς ἐστι καὶ νῆρον*, the child or the Infant. This surely is an excellent distribution, but for those that are rude such as we intend to informe, a great deale too darke and obscure. Wee will therefore endeavour our selues more manifestly to shew vnto you the whole proceſſe of Nature in the conformation of a man, and in what order all the parts are at first orderly delineated.

Natures proceſſe.

First the membranes.

Whilst the spirit, the instrument of the soule, beginneth to work vpon the masse of seed which to see to is vniforme, but indeed full of Heterogeny or different parts; First of all it seuereth the parts which are Heterogeny or vnlike one another, the thinner more noble and better furnished with spirits it hideth within; the thicker, colder and clammy (which most part are supplied by the mothers seede,) it compasseth about the former. At these cold and viscid parts of the seed it beginneth the conformation, for of them it maketh membranes, and stretcheth them out in breadth according to Natures vse and intent, shewing therein her admirable providence. For with these, as it were with defences, the more noble part of the seed is walled about and secured, and the inward spirits concluded or imprisoned which otherwise because of their tenuity would easily vanish. Adde farther, that if the membranes had not first beene made, the tender *Embryo* and the principal parts thereof would haue suffered offence from the hardnes of the wombe.

In Beasts 3.

For euen as God in the great world hath separated the fire from the earth by the interposition of water and ayre, so in the *Microcosme* or little World, the Nature of man imitating the grand Architect hath separated the Infant from the womb by the interposition of these membranes. But the nature of these membranes is not all one in Beastes and in men. For in beastes, especially such as haue hornes, we haue obserued three membranes called *Chorion*, *Amnios*, and *Allantoides*. That we call *Chorion* cleaueth wholly to the womb by the interposition of the vmbilicall veines and arteries, and in this membrane are to be scene those *Cotyledones* wouen of a fleshy and spongy substance. The second membrane called *Amnios* is thinner then the former; this compasseth round about the Creature and is thought to be the receptacle of the sweate. The third is called *Allantoides*, because it is much like that we call a Haggas pudding, for it doeth not encompasse all the Creature but only from the Breast-blade to the Hips, and may be compared to a girdle or broad swathe, and is sayed to contayne the vrine of the Creature whilest it is in the wombe. In a man there are onely two membranes to be found, the first and the second called *Chorion* and *Amnios*. The *Chorion* is nervous and strong, and encompasseth the Infant round whence haply it hath his name, either because it compasseth it as a circle or crown, or because it is *σῆμα ἑμῆς*, the conceptacle of the Infant, or because it supplyeth nourishment vnto it, for so much *χρησι* soundeth.

In men two.
Chorion.

Why in women the *Cotyledones* are not found.

This membrane like a soft bolster or pillow susteineth and supporteth al the veines and the Vmbilicall arteries; for it was not safe that the vessels of the Infant issuing out of his Nauill should go so long a journey naked without defence. In them are not (as in bruit beastes) those *Cotyledones* or knobbes like the Teates of the Breast, but only a fleshy masse made of infinite branches of veines and arteries wonderfully implicated or wouen together and filled vp with blood which supplyeth the place of those *Cotyledones*. The later writers call it the cake or Liuer of the wombe, and some *orbicularem affusionem* the round affusion. Whose vse is as another Liuer to prepare and boyle the blood for the nourishment of the Infant. Wee do rather call this round and red body (like the orbe of the Moone when it is at the full) which cleaueth onely to one part of the wombe and doth not wholly encompasse the Infant, *παχύρεας* or *καλὰ* *ἀσπῆς* the Sweete-bread of the wombe, and doe assigne vnto it that vse that the Sweete-bread hath in the lower belly, to wit, safely to support and as a pillow to beare vp the vmbilicall vessels diuersly sprinkled through the *Chorion*. But it may be demanded why an Infant hath not those *acetabula* or *Cotyledones* to tie the *Chorion* firmly to the wombe as it is in beastes? haply because a woman doth not bring forth so many yong as beastes doe; or because the wombe of a beast swelleth more outward, and therefore could not beare their burthen vnlesse it had beene fastned with stronger ties.

The vse of the cake.

Amnios.

His vse.

The other coate which immediatly encompasseth the Infant, from the softnesses and thinnes thereof is called *ἀμνίος* the Lambs-skinne: others call it the shirt, and the Arabians *Abigas*. It is loose on every side vnlesse it be at the place of the cake, where it groweth so fast to the *Chorion* that it can hardly be separated; and this coate receiveth the sweate and the vrine from whence the Infant hath no small help, for it swimmeth as it were in these waters or is couched in them as it were in a bath: beside, it maketh the birth more facile and easy because it moistneth the orifice of the wombe and maketh it more slippery.

These

These coats growing one to another seeme to make but one covering, which the Greeks cal *δευτερον καὶ ὅτι* *secunda* or *secundina*, either because it issueth last out of the womb in the birth whence we cal it commonly the *Afterbirth*, or because it is a second habitation for the Infant, the wombe being the first.

The after
birth.

The inner or more noble part of the seed being secured by these membranes or coats, more boldly vndertaketh the forming of the parts. At that time therefore the spirit walketh through the whole body of the seed, and because there are two faculties assistant to the procreating faculty, that is to say, the changing & the Forming: therefore first of all the seed is altered or changed and disposed; then almost in the same instant the first threds of the spermatall parts are together and at once skored or shaddowed out as it were in rude lines, and that is the first worke of the *Forming faculty*.

Then are to be seene three bubbles or cleare drops such as the raine rayseth when it falleth into a riuer, which are the rudiments of the three principall parts, & beside a thousand strings which are the warp, as it were, of the vessels and the spermatall parts. So that it is very likely that those oracles of *Hippo.* in his 1. book *de diata*, & in his book *de locis in homine* are most true, where he sayeth, that all the parts are inchoated or begun together, but doe not appeare neither are perfected at once but by degrees. But at what time whether the 5. or the 7. day, all these begin to be figured, he only the Creator who maketh the Infant knoweth, and none else. Yet if we will rely vpon *Hippocrates* authority or vpon our experience, which is very tickle, we may say, That the 7. day the seed hath what soever the body ought to haue, that is as I interpret it; the 7. day doe appeare the rudiments of all the spermatall parts, which also your eye may discern if you cast the masse into faire water and then diligently view it. These foundations of the spermatall parts being thus layed, every one is after accomplished in their owne order, 1. those that are most noble and most necessary, as the 3. principall parts, the Braine, the Heart and the Liuer, and the vessels to them belonging, Nerves, Arteries and Veines. The Veines are propagated from the Liuer euen to the *Chorion*, and to the same membrane are deriued arteries from the *iliacall* branches, and doe ioine with the mouths of the vessels of the wombe, so that these Vmbilicall vessels by which the Infant draweth his breath are the of-spring of more inward vessels contrary to the common opinion of the vulgar Anatomists.

The foundati-
ons of the parts
are layd at
once.
3. bladders,
Hippocrates.

The 7. day the
parts are deli-
niated.

What parts are
first formed.

The harder and more solide parts are figurated together, but not together perfected. For of the bones some are sooner perfected some later. The ribbs the lower iaw, the smal bones of the eares, the patell or collar bones, the bone *hyois*, are all bones euen from the first originall. The bones of the arme, the legge and the thigh haue their heads imperfect and meerly gristly; the bones of the vpper iaw, of the hands, of the whole spine and the rump, are nothing else at the first but gristles.

Their order.

The cause of the more speedy forming or perfecting of any part is to be referred to the vse thereof, that is, to the necessity of the finall cause; and therefore the ribbes because they make the cavity of the Chest are at first made bony, least otherwise the bowels should be compressed. The lower iaw was very necessary instantly after the birth of the Infant for his sucking & other motions. The small bones of the eares that they might rebound the better, needed be dry and hard. The patel or collar bones were necessarily made strong at the first, because they tye the arme and the shoulder blade to the trunk of the body; as also the bone *hyois* to establish the tounge. And thus may we make estimation of the other parts; in the delineation whereof the Forming quality perpetually laboureth, neuer resting till it haue made an absolute separation & description of them al. This is performed in male children the 30. day, & in females the 40. or the 42. day. So sayth *Hippocrates* in his Book *de Natura pueri*, and *de septimestri partu*. A woman child hath her cōformation at the farthest the 42. day, and a man child at the farthest at the 30.

The causes of
this order.

At what times
the conforma-
tion is accom-
plished.

This is the first conformation of the Infant made only of the body or substance of the seed, which the creature exceedeth not in magnitude. For saith *Aristotle* in his 7. Booke of his History of Creatures and the 3. chapter, If you cast the *Embryo* into cold water it will not appeare bigger then a great Pismyre; but I sayth *Laurentius*, haue often seen an Infant of 40. dayes old, as long as a mans little finger.

There is another conformation of the Infant of the other principle of Generation, that is of blood, of which the fleshy parts are framed, as the spermatall are of seed. This blood floweth through the vmbilicall veine, which is a branch of the gate veine filling the empty distances betweene the fibres, or threds of the seed.

The second
conformation
from the blood.

But whereas there are three sorts of flesh; that which groweth to the bowels they call *παρ' ὅρου*; that which adhereth to the fibres of the muscles they call absolutely flesh; and the

3. sorts of flesh.

The order of
this conforma-
tion.

third is that which is proper to every particular part. This threefold flesh we say is not generated together and at once but in order: first the *Parenchymata*, next the flesh of the particular parts, and last of all the flesh of the muscles. Of the *Parenchymata* the first that is formed, is that of the Liver, because the umbilical veine first powreth out the blood thereinto; then the *Parenchyma* of the heart, then those of the other bowels. And this is the manner and order of the conformation of the Infant, and of all the parts thereof.

CHAP. VI.

Of the Nourishment of the Infant, and how it exerciseth the Naturall Faculties.

Three kinds
of life.

IN the workes of Art men do proceed from that which is lesse perfect to that which is more perfect; right so is it in the workes of Nature. Wherefore the tender *Embryo* liueth first the most imperfect life, that is, the life of a Plant which we call the Vegetative life. Afterward growing vnto further strength, it attaineth the life of an vnreasonable creature which we call the Sensative life; and last of all the most perfect life of a man when it is endued with a reasonable soule. This *Aristotle* teacheth in his 1. Book *de generatione Animalium* where he saith, *the Infant is not made a living Creature and a man together*. But wee must vnderstand that this progresse in perfection commeth not by reason of the forme, because that is simple and cannot be diuided, but by reason of the matter, that is, of the Organes, which that noble forme and *first acte* vseth for the accomplishment of *second acts* as we call them, and all the Functions.

Aristotle.

Two kinds of
Nourishing.

The 1. life of the creature whereby it liueth from the very beginning of the Conception, is the most simple; and is maintained without that which we properly call Nourishment. And indeede what neede was there of Nourishment or restauration where there was no exhaustion or consumption of the parts? The *Embryo* at first hath sufficient to cherish it selfe out of it owne heate, and by it owne inbred spirit. But after the parts are distinguished and delineated, then presently it beginneth to be nourished and encreased, yet is not this nourishment of the same kind with that which the Infant enioyeth after it is ariued into the world. For then it sucketh Aliment by the mouth, but whilst it is in the wombe it receiueh it only by the Nauell, whatsoeuer *Democritus* and *Epicurus* say. And that did *Hippocrates* not obscurely intimate, when hee said in his Book *de Alimento*, *ἡ δὲ ἀρχαιότερον τροφή διὰ τὴν ἐπιγαστρὶν οὐραλόε*. that is, *The first Nourishment is the Nauell through the Abdomen*. After it is borne it swalloweth into the stomach meats of all kinds, before (saith *Hippocrates* in his Book *de natura pueri*) it draweth onely of the purest blood from the Mother, which is transfused into the Liver. The Infant after it is borne maketh manifold changes and alterations in the Aliment: first *Chylification*, then *Sanguification*, lastly perfect *Assimilation* which is the third concoction. Before when the Infant draweth pure blood, it giueth not thereto any new forme, but only a perfection and temper like vnto it selfe. Wherefore we ascribe to the Infant not *Chylification* nor *Sanguification*, but only the third concoction which is the particular Nourishment of the singular parts. The manner of this third & onely concoction in the Infant contained in the wombe, is thus.

One only acti-
on in the nou-
rishment of
the infant.

The true way
how the infant
is nourished.

The Infant being tyed by the mediation of vessels and membranes to the Mothers wombe, draws the purest of her blood through the mouths of those vessels inoculated one into another after a wonderfull manner. This blood thus drawne is powred into the body of the Liver through the umbilical veine, which is a branch of the gate veine, and reacheth to the Fissure of the Liver, yea you may often in dead bodies follow a probe out of it into the small veins of the Liver: Here the blood is more and more perfected, afterward the thicker and more crude part is distributed through the roots of the Gate veine into the stomacke, the spleene and the kidneyes, the excrements and reliques whereof by the spleenick and mesenterick branches are ablegated into the cauity of the guts, and there are by degrees gathered together, and in their abode are so dried that they become thick and black. The purer and better concocted part of the blood is conueyed into the trunk of the hollow vein, from which it is diffused through the whole body by the veins, as it were by small Riuer. But because the blood is not without his whey, which serueth to weft it through the small veins, therefore the whey hauing performed that his office, is partly spent in sweate by the habite of the body, partly it is drawne by the kidneyes, and so transcolated through the Vreters or vrine vessels into the bladder. For the containing of which sweat and Vrine, Nature appointed the Membrane called *Amnion*. Yet we must

The excrements
of the Infant
whereba-
stowed.

must not thinke that the Infant pisseth his vrine into his Membrane by the priuities, but it is conveyed therinto thorough the *Vrachos*, which is a long and bloodlesse Canale or pipe lengthened from the bottom of the bladder vnto the nauell. Neither hath it any Muscled belonging, because in the Infant no time is vnseasonable for the auoyding of these excrements; whereas when we auoide our vrine, we haue Muscles at the roote of the yard, to stay or to further that euacuation that it might not be performed but in conuenient time, and at our best leifure as before is said.

The vse of the *Vrachos*.

CHAP. VII.

How the Infant exerciseth his vitall Faculties.



He Infant also liueth in the womb farre otherwise then he liueth after he is borne; for neither is the chest distended & contracted, because he draweth not his breath by his mouth, neither doth he engender any vitall spirits because he draweth them from his Mother: neither lastly doth he neede the motion or worke of the Heart or the Lungs, but the heate of the particular parts is cherished, preserued and refreshed onely by Transpiration & the pulsation of the arteries, which he hath from the arteries of the mother.

The dissimilitude of the life of the Infant before and after birth.

This different life hath also a different structure, substance and vse of the vital organes, which because it hath not bene long knowne to any Anatomists of this age; albeit it was first of all discovered by *Galen* in his 61 and 15. Books of the *Use of Parts*, though obscurely; we will endeavour to make it as manifest and plaine as possibly we can.

Galen's wonderful Observations

In the *Basis* of the heart, that is, in the broad end, there appeare foure notable vessels, two in the right ventricle, the hollow veine, and the arteriall veine, and two in the left, the great Artery, and the venall Artery. The vse of these after we are borne is this. The Hollow veine which gapeth with a wide mouth into the heart, powreth the blood into the right ventricle as it were into a wide Cisterne, there it is reboyled and attenuated as well for the generation of vitall spirits as also for the nourishment of the lungs. A part therefore of it sweareth through the middle wall betwixt the ventricles into the left ventricle. Another part is carried by the Arteriall veine into the thin, rare, and spongy substance of the Lungs. The Venall Artery leadeth into the left ventricle the aer which we breath in, prepared before in the lungs where it is mingled with the blood, of which permixtion the vitall spirits are generated. This spirit the heart driueth into the trunk, and so into the branches of the great Artery. In the Infant before birth all these things are otherwise, and a farre other vse is there of all these vessels.

The vse of those vessels after birth.

For the hollow veine doth not poure this streame of blood into the right ventricle, because neither the Lungs stand in need of attenuated blood, being at that time all of them red, thicke, and immoveable, neither is there any generation of vitall spirits. The venal artery leadeth not the aer into the left ventricle, because the Infant doeth not breath by the mouth, but only hath vse of Transpiration. The great artery receiueth no vitall spirits from the heart, but by the umbilicall arteries: and therefore the arteriall veine doth not the office of a veine but of an artery, for it carrieth onely vitall spirits, but no blood. Againe, the venall artery doth the office of a veine, containing only thick and hy coloured blood for the nourishment of the Lungs. But because there was no passage from the Hollow veine to the venall artery, Nature ioyned these two vessels (which doe but touch one another) by a large and round hole through which the blood hath free passage from the Hollow veine, to the venall Artery.

The vse of the vessels before the Infant is borne.

To this hole shee hath also set a thin and cleare Membrane like a couer, which should giue way to the blood rushing out of the Hollow veine, but should prohibit it for returning again therinto. As also that by means of this membrane, the hole after birth (when there is no more vse of it) might sooner be souldered vp, hauing a principle of consolidation so neere and ready at hand. And because the arteriall veine and the great artery were distant a litle space each from other, shee hath ioyned them by a third pipe or Canale of the Nature of an Artery running a slope betweene them, that so the vitall spirit might passe freely from the great Artery into the Arteriall veine.

How the vessels of the heart are vnited.

This is that admirable vnion of the vessels of the heart in the Infant vborne, to wit, of the Hollow veine with the Venall artery, and of the great Artery with the Arteriall veine; but the shutting vp and reficcation of these vessels within a few dayes after the birth, that is indeed beyond all admiration. For that large hole whereof we spake, is so closed that there remaineth

The wonderful reficcation of the passages after birth.

no footsteps or signe of it. As for the third arteriall pipe or canale, within a few dayes it withereth and shrinketh together, & at length it groweth so small that no man would belecue there were any such thing.

Hence it may be concluded that the Infant in the womb draweth his mothers spirits by the Vmbilicall Arteries, and liueth contented onely with the pulsation of the Arteries, not at all needing the help or motion of the heart.

CHAP. VIII.

Of the motion and scituation of the Infant in the wombe, which are Animall faculties.

Why the Infant
moueth not
the first 3.
months.

His Soule being an *entelechia* or act of an Naturall organical body, doeth not nor can performe her functions without a conuenient organ or instrument. Wherefore in the first months the tender Infant by reason of the weaknes of the Braine and softnesse of the sinews is not able to moue his members. But when the bones begin to gather strength, and the nerues, membranes and ligaments, which before were full of a mucous and slimy humor begin to dry, then the Infant kicketh and moueth.

When the motion begins.
Hippocrates

The first beginning of this motion sayeth *Hippocrates* in his Booke *de Naturapueri*, and *de morbis Mulierum*, is in Male children at the 3. month, in Females at the 4. so that there is a certaine and definite proportion of the conformation and the motion of the Infant, and a double time comming between them. Male children therefore because they haue their conformation the 30. day doe moue the 90. now the 90. day maketh vp the 3. month. Females because they haue their cōformatiō the 42. day, they are moued the 120. which fulfilleth the 4. month.

The Infants
motion voluntary.

This motion of the Infant is not Naturall but voluntary, as being perfourmed by the helpe of the Muscles contracting themselves. The Muscles are contracted because the Soule so commaundeth. This commaundement is carried by a corporall spirit and conuayed thorough the Nerues, which spirit is daily generated (in the *Sinus* of the Braine or in his substance) of the Vitall which the Infant receiueth from the vmbilicall Arteries.

The scituation
of the Infant.

To this moouing faculty we must also referre the scituation or position of the Infant in the wombe. For so *Hippocrates* in his *Prognostikes* referreth the position or manner of the sick-mans lying (either prone that is downeward, or supine that is vpward, or on either side) to the weaknes and strength of the moouing faculty.

The naturall
scituation.
Hippocrates.

The Naturall scituation of the Infant is thus described by *Hippocrates* in his Booke *de Naturapueri*. *The Infant as he is placed in the wombe hath his hands at his knees, and his head bent downe to his feete.* Wherefore he sitteth in the wombe crumpled, contracted or bent round, holding his knees with his hands and bending his head betweene them, so that each eye is fixed to the thumbe of either hand, and his nose betwixt his knees.

Figura media
what it is.

This Figure though it be not exquisitely the *meane* or middle position as we call it, that is, so Naturall as that all the parts are in their due position; yet it commeth neere thereunto, and therefore is neither paynfull nor wearisome to the Infant; and for the mother very conuenient because thus the Infant taketh vp the least roome, & beside riseth not so high that it should presse or beare vp her midriffe or stomacke, as we see in some women when their burthen lyeth high they are short breasted and much more vawealdy as we vse to say.

The reason of
the position.

Moreouer this position is most fit for the easy birth of the Infant, for lying thus with his head betwixt his legs, when he seeketh meanes to get out, he is sooner turned with his head downeward to the orifice of the wombe, which manner of trauell is of all other the easiest and most secure, both for the Infant and the mother, as shall better appeare in the next Chapter.

CHAP. IX.

The exclusion or birth of the Childe.



He tender and soft particles of the Infant being now all perfected and established, he becommeth euery day greater and hotter, and requireth more nourishment, and being now not contented onely with transpiration, desireth and striueth after a more free vse of the ayre.

Now

Now when as the mother is not able to supply vnto the Infant either the ayre wherby it liueth in sufficient quantity through the narrow vmbilicall arteries, or other nourishment by the vmbilical veines, whereby it might be increased and refrigerated, the Infant then as it were vnder-taking of himselfe a beginning of motion, striueth to free himselfe from the prison and dungeon wherein he was reſtrayned; kicking therefore he breaketh the membranes wherein he was inwrapped, and arming himselfe with strong violence maketh way for his enlargement with all the strength and contention that he may.

This contention and distention the wombe ill brooking, and besides being overburthened with the waight of the Infant now growne, striueth to lay downe her load, and with all her strength by that expulsive faculty wherewith she is especially furnished she rouseth vp her self, and with violence thrusteth her guest out of possession of his true inheritance.

Thus the ioynt strife and as it were consent betwixt the Infant and the wombe bringeth to light a new man, not vpon his feete, nor side-long, but as diuine Hippocrates hath foreshewed *ἐπὶ κεφαλῇ*, that is head-long, so be his out-gate bee naturall. The reason is, because the vpper parts which hang vpon the Nauell string as at the beame of the ballance, doe ouerway the neather.

Furthermore, this strife and contention of the Infant and the wombe is assisted by the voluntary endeour of the woman in trauell, which is by drawing in her breath & by that meanes bearing down the midriffe: adde hereto the skilfull hand of the headf-woman or Midwife as we call them, for she setteth the woman in a due posture or position of parts, receiueth the Infant gently which falleth from betwixt her knees, directeth it, if it offer it selfe amisse; and finally draweth away as easily as is possible the afterbirth which stayeth behind.

Here Galen in his 15. Booke *de usu partium*, breakes out into an admiration of the immortal God; for the mouth or orifice of the womb, which in the whole time that the burthen was carried, was so exquisitely closed vp, now enlargeth it selfe to that extent that the body of the Infant passeth through it.

This birth hath no certaine or limited time in man as in other creatures, but hapneth vncertainly at any time of the yere: the reason is, because other creatures haue set times of copulation, but man because the propagation of his kinde was most necessary, is not tyed to any time or season, but left to the liberty of his appetite and guidance of his discretion. Adde hereto; that other creatures in their coitions are glutted & more then satisfied: man (I know not how) hath his appetite encreased euen in the fruition of that which he affecteth. Other creatures vse alwayes one and the same manner of dyet, which may be a bridle and restraint: Man wandreth wantonly through infinite varieties of viands and delicacies whereby he is goaded and prouoked to intemperate lust. I forbear to speake of the power of those fancies, lustfull imaginations and passions whereby euery houre as by so many furies he is racked and tormented: all which we know are of great auaille to alter the body of man.

The times of the birth of man are the 7. 8. 9. 10. and 11. months. The 7. month is the first time, because before it an Infant cannot be borne alieue into the world, neither indeede is such an exclusion properly called a birth, but an abortment. The 11. month is the last time and vtmost limit, which whosoever exceedeth, is decciued in the time of her conception, and the *Cat*, we say, hath eaten her marke. The middle months are the 8. 9. and the tenth.

By a month we meane with Hippocrates that which they call *mensis solaris*, that is to say 30. dayes. Not that the birth which we call *Septimestris*, or *Nonimestris*, or *Decimestris* doe each fulfill seuen or nine or ten whole and compleate months: for we know that there is a great latitude of the seuenth and tenth months, so that the Infant that is borne in the beginning or middle or end of the seuenth month is truly called *partus septimestris*. The beginning of the 7. month Hippocrates designed in his Booke *de septimestri partu*, where he sayeth that those Infants which we call *septimestres* are brought into the world within an hundred and fourescore daies and a peece of a day. The end of the seuenth month he limiteth in his Booke *de principijs*, where he saith that the *septimestris partus* is circumscribed within thirty weekes, that is two hundred and ten dayes; for 7. times 30. amounteth to that number.

The Infants called *Octimestres*, that is, such as are borne the eight month do neuer liue, vnlesse happely in Egypt, because the heauen and the soyle are there most gentle and benigne. The birth at nine months is most legitimate and to Nature most familiar. In the tenth month trauel is not so vocouth, in the eleuenth most rare.

But why the 7. month & the 9. should bring forth liuing Infants not the 8. the Pythagorians do refer to the power and efficacy of Numbers, the Geometricians to the duplicated proportion

The causes of a womans deliuerance.

In what manner the Infant is borne.

Galen's admiration at the providence of God.

The time of trauell vncertaine.

The time of mans birth.

Hippocrates.

Septimestris partus what it is.

Why the Infant
borne the 7.
month surui-
ueth.
The Physitians
reasons,

of the conformation and the motion, & the triplicated proportion of the motion to the birth. The *Astrologians* refer it to the diuerse and different Aspects of the Planets and Stars. But these are meere toyes.

The Physitians vpon better grounds haue found out certaine and established rules of Nature; and her ordinary Circuites and Returnes, which vnlesse shee be interrupted or prouoked, shee neuer either hasteneth or forefloweth. Wherefore seeing the Infant in the seuenth month becommeth perfect, not wanting any accomplishmēt of his parts, if at that time he haue strength sufficient, hee breaketh the Membranes and worketh out his passage, liuing and suruiuing because he is perfect, especially if it be a male childe.

But in the eight month if he be borne, albeit he haue the perfection of his parts, yet he suruiuech not, because he is not able to endure two instantly succeeding afflictions (as wee call them) or contentions; for the seuenth month being now perfected he laboureth sore and striveth for his enlargement. If therefore being weakened by that strife he againe returne to labor before hee bee refreshed, it is impossible hee should hold out or suruiue so great expence of strength and spirits, but must needs sink and faile.

Why the 8.
month Infant
liuech not.

Furthermore, at the eight month the Infant doth not liue, because he commeth after the day of birth which should haue been in the seuenth month, and before the day which is to be the ninth.

The subiect of
the Contro-
uersies follow-
ing.

Whereupon we gather, that some euill accident hath berided him, which either hath hindred his birth the seuenth month, or preuented his stay till the ninth. But because these things are somewhat obscure, we referre you for further satisfaction to the Controuersies next enliuing, wherein we will labour to assoile not onely this difficulty, but also all others which may arise concerning the difference and temper of the Sexes, the Nature and Effusion of the seede, the quality and causes of Excretion of the Mothers blood, the Lawfulness and Errors of Conception, the manner and time of Conformation, the Growth and encrease of the Infant, and how it exerciseth the Naturall, Virall and Animall Functions; and finally, concerning the Nature, Differences, Times, and Causes of the Birth.



A Dilucidation or Exposition of the Controuersies concerning the Historie of the Infant.

QUEST. I.

Of the Difference of the Sexes.

The necessity
of the distin-
ction of these
sexes.



Aristotle in his Bookes of the History and Generation of Creatures, doth often inculcate that the difference of Sexes is most necessary vnto perfect Generation, which is also sufficiently proued by the Final cause the most noble of all the rest, moouing the other causes, it selfe remaining immouueable. For as in the seed of a Plant, the power of the whole tree is potentially included & contained, which notwithstanding neuer breaketh into act, vnlesse that act be stirred vp by the heate of the earth; Right so, the seeds of the Parents containing in them the Idea or forme of the singular parts of the

the body, are neuer actuated, neuer exhibite their power and efficacy, vnlesse they be sown and as it were buried in the fruitfull Field or Garden of Nature, the wombe of the woman.

It was therefore necessary that there should be a double creature, one which should beget in another, and another that should generate in it selfe: the first we call a Male, the second a Female. The Male is originally the hotter, and therefore the first principle of the work, and besides affordeth the greatest part of the Formative power or faculty. The Female is the colder, and affordeth the place wherein the seede is conceiued, and the matter whereby the Conception is nourished and sustained, which matter is made of the crude and raw remainders of her owne aliment. The place is the wombe, which by a naturall disposition looseth the bondes wherein the spirit of the seed is fettered, and withal helpeth to adde vigour and efficacy thereunto. For if the seed should be powred into any other part of the body it would not be as we vse to say, Conceiued but putrified; not preserued, but corrupted. The matter whereby the seed is nourished is the Mothers blood. The excrement or surplusage rather the last aliment of the fleshy parts.

This difference of the Sexes do not make the essentiall distinctions of the creature: the reasons are: First because (as Aristotle sayth in his second Booke *De Generatione Animalium* and the 4. Chap. and in his 4. Book *De Historia Animalium* and the 17. Chap.) in all creatures there is not this distinction or diuersity of Sexes. Secondly, because essential differences do make a distinction of kinds: now we know that the Male and Female are both of one kinde, & onely differ in certaine accidents. But what these accidental differences are is not agreed vpon as yet.

The *Peripateticks* thinke that Nature euer intendeth the Generation of a Male, and that the Female is procreated by accident out of a weaker seede which is not able to attaine the perfection of the Male. Wherefore Aristotle thinketh, that the Woman or Female is nothing else but an error or aberration of Nature, which hee calleth *παράβασις* by a Metaphor taken from Trauellers which misse of their way and yet at length attain their iournies end; yea hee proceedeth further and saith, that the Female is a *by worke* or preuarication, yea the first monster in Nature.

Galen in the 6. and 7. chapters of his 14. Booke *de usu partium*, following Aristotle something too neere, writeth, that the Formative power which is in the seede of man being but one, doth alwayes intend the generation of one, that is the Male; but if she erre from her scope and cannot generate a Male, then bringeth she forth the Female which is the first and most simple imperfection of a male, which therefore he calleth a creature lame, occasionall and accessary, as if she were not of the *mayne*, but made *by the bie*.

Now heerein he putteth the difference betwixt her and the Male, that in Males the parts of Generation are without the body, in Females they lie within because of the weakenesse of the heate, which is not able to thrust them forth. And therefore he saith, that the necke of the wombe is nothing else but the virile member turned inward, and the bottome of the wombe nothing but the *scrotum* or cod inuerted.

But this opinion of Galen and Aristotle we cannot approue. For we thinke that Nature aswel intendeth the Generation of a Female as of a Male: and therefore it is vnworthily said that she is an Error or Monster in Nature. For the perfection of all naturall things is to be esteemed and measured by the end: now it was necessary that woman would be so formed or else Nature must haue missed of her scope, because she intended a perfect generation, which without a woman cannot be accomplished.

Those things which Galen vrgeth concerning the similitude of the parts of generatio or their differing only in scite and position, many men do esteeme very absurd. Sure we are that they fauour little of the truth of Anatomy, as we haue already prooued in the book going before: wherein wee haue sheweth how little likenesse there is betwixt the necke of the wombe & the yard, the bottome of it & the cod. Neither is the structure, figure, or magnitude of the testicles one and the same, nor the distribution & insertion of the spermatick vessels alike; wherefore we must not thinke that the Female is an imperfect Male differing onely in the position of the Genitals.

Neither yet must we thinke that the Sexes do differ in essentiall forme and perfection, but in the structure and temperament of the parts of Generation.

The woman hath a wombe ordained by Nature as a Field or seed-plot to receiue, conceiue & cherish the seed; the temper of her whole body is colder then that of a man; because she was to suggest and minister matter for the Nourishment of the Infant. And this way Aristotle in the second Chapter of his first Booke *De generatione Animalium* seemeth to incline,

What the Male is.

What the Female is.

The difference of Sexes is not essentiall.

Aristot. Error.

Galen. Error.

Disproued.

No similitude betwixt their Genitals.

How the Sexes are distinguished.

where

where he sayeth that *the Male and Female doe differ as well in respect as in sence*: In respect, because the manner of their generation is diuerse, for the female generateth in her selfe, the Male not in himselfe but in the Female: In sence, because the parts appeare other, and otherwise in the Sexes. The parts of the Female are the wombe and the rest which by a generall name are called *matrices*; the parts of a man are the virile member and the Testicles. And so much shal bee sufficient to haue beene added concerning the difference of the Sexes. But because there is more difference of the Tempers in men and women, we will insist somewhat more vpon that point.

QUEST. II.

Of the Temperament of women, whether they are colder or hotter then men.



Concerning the Temperament of Men and Women there is a notable controuersie, which if I may take vpon me to censure or arbitrate, I wil briefly acquaint you with what I haue gathered concerning this matter, out of the fountaines of the Grecians, and Cisternes of the Arabians.

There are some which thinke that women are hotter then men: others on the contrary, that men exceede women in heate by many degrees: Neither of these opinions want patrons to defend them, nor reasons to sustaine and support them.

That women
are hotter then
men.
Hippocrates.

If the Edicts of *Hippocrates* our Dictator doe stand for a Law, as truely they deserue well to doe, then shall mens part goe to the wall; for in his first Booke *de morbis mulierum*, he plainly auoucheth that women are hotter then men, his words are these: *I say that the flesh of a woman is more rare then that of a man*. Now rarity with the Philosophers is the worke of heat, to wit, his secondary quality; as it is the property of cold to condense or thicken: so it is the property of heate to rarifie or make thin. Againe in the same place he sayeth that the body of a woman draweth more suddenly and more abundantly the moysture out of the belly, then the body of a man.

Now we know that sudden and abundant traction is not accomplished without the help of notable heate, and therefore it is that *Hippocrates* in this 6. Section of his 6. Booke *Epidemion* calleth *carnes attractices*, because they are very hot. Finally, let vs see what *Hippocrates* inferreth vpon this rarity of the flesh and strong attraction of moysture. *The woman hath hotter blood, and therefore is hotter then a man*; what could he say more plainly? what more determinately?

Reasons for
this opinion.

Of the same opinion was *Parmenides* as *Aristotle* reporteth in the second chap. of his second Booke *de partibus Animalium*. But let vs see how this opinion of *Hippocrates* may be established by reason.

The first

The Temper of the whole body is to be esteemed according to the Temper of the principal parts, especially of the heart and the Liuer; and this we haue from *Galen* in his Booke *de Temperamentis*, and *De Arte parua*, where he saith: *Those whose heart is hot, are also of a hot habite of body, vnesse there be some obstacle in the Liuer; and those that haue hot Liners haue also hot habits vnesse there be some repugnancy in the Heart*. But if both these bowels doe conspire in the same Temper, then of necessity must the Temper of the whole body be like vnto them; but the Heart and the Liuer of women are hotter then of men; and therefore their whole bodies are also of a hotter temper then mens.

A womans
heart hotter
then a mans.

That the heart of a woman is hotter then the heart of a man may thus be demonstrated: the Temper of the particular parts is especially known by the strength of their action; now the actions and faculties of the heart are two, vitall as say the Physicians, and *humidus* or *irascibilis*, that is, the passion of anger as say the Platonists. Both these are more operative and liuely in a woman then in a man. The vitall faculty shyneth most evidently in the pulse.

Now the pulses of women are more quicke & frequent, of men more rare and slow as *Galen* teacheth in the 9. Chapter of his Booke of pulses *ad Tyrones*, and in the 2. chapter of his 3. booke *de Causis pulsuum*. That also *Auerroes* affirmeth in the 4. colliget: and the 19. chapter. But the frequency & swiftnesse of the pulse bewrayeth the strength of the heate; for as it is the property of cold to make the parts sluggish and dull in their motion; so heate moueth them briskly, and giueth them no rest at all.

The other faculty also of the heart which we called *irascibilis* or the passion of Anger, many of

of vs know by woeful experience to bee quicker and more vigorous in woemen then in men, for they are easily heated and vpon sleight causes; but Anger with *Galen* in his Booke de *Arte parua* is a signe of a hot heart. Hence it is that females are more bold and cruell then males. For Hunters affirme, that of Tygers, Beares, and Lyons, the females are farre fiercer then the males.

Women sooner
angry then
men.

That the Liuer of a woman is hotter then the Liuer of a man may bee proued by the same demonstration. The Naturall Faculty which hath his residence in the Liuer and is diuided in to the encreasing, nourishing and procreating vertues, is stronger in a woman then in a man. For we see that wenches grow faster then boyes, become sooner ripe and yeeld seede sooner, which is the worke of the generatiue Faculty, they are also more wanton and lasciuious, as hauing the Testicles hid within their bodyes, by which they are heated. For *Galen* saith the Testicles after the heart, are as it were another heart of Naturall heate.

The Liuer of a
woman hotter
then of a man.

The procrea-
ting Faculty.

The nourishing Faculty, which is a certaine signe of the heat of the Liuer, is more perfect in a woman then in a man, for their liuer engendreth more blood; now so much blood as we haue so much heate haue we also. Neither is this blood of theirs of any hurtfull or ill quality, but onely offensive in quantity. Beside the habit of the women is more fat, plump and delicate to see to and to feele, and altogether without haire.

The Nourish-
ing Faculty.

Finally, in women all the Animall Faculties are most perfect, their senses most sharpe, their Muscles more nimble and deliuer to mooue their ioynts, their memories more happy, their inuention more subtile, their words, which expresse the conceit of the mind, more plenti- full and abundant, and therefore *Virgile* expressing the communication of the Gods, makes *Jupiter* begin and *Venus* to answer, but addeth:

The Animall
Faculty.

*Jupiter hac paucis, at non Venus aurea contra
Pauca refert.*

Aenci. 10.

Thus in few words did *Jupiter* his royal sentence end,

But *Venus* faire in many more did thus her cause commend.

If therefore all the Faculties, Vitall, Naturall and Animall, are in women more perfect then in men, who will deny but they are also hotter then men? Neither will we passe ouer in silence that which *Macrobius* hath obserued in the 7. Booke of his *Saturnalia*, What time the bodies of men were burnt, to euery ten men they put the body of a woman, to make them the sooner take fire.

*Macrobius.
Saturnal.*

These things are indeede probable, and couered ouer with a veile of truth, which notwithstanding if we weigh in the ballance of Philosophie and of Physicke, they will appeare to be as light as vanity it selfe; we will therefore maintaine the other opinion, that men are generally hotter then women. And this we will confirme by strong and substantiall reasons, as also by authority of the best and most authenticke Authors.

That men are
hotter then
women.

There are very many things which will euince this truth, but these among the rest. The Principles of Generation; the Place in which, and out of which the Infant is generated; the Conformation; the Motion; the time of Birth; the Purgation after Birth; the Structure and Habit of all the parts; the manner of Diet and course of life: And finally, the Finall cause. All which we will briefly run through.

The places
from which
the arguments
are fetched.

If we consider the Principles of Generation, Men are generated of hotter seede then woemen. This hath *Hippocrates* elegantly declared in his first Booke de *dieta*. For acknowledging a double or twofold kinde of seede in both Sexes, a Male seede and a Female, he concludeth that of the male seede, that is the hotter and more vigorous, a man is generated; out of the weaker a Woman. Moreouer, men are generated in a hotter place. *Hippocrates* in the 48. Aphorisme of the first section, saith, Male infants are borne on the right side, females on the left. Now we know the right side is hotter then the left by reason of the Liuer. For the heart is indifferent and in the very midst, especially the Basis thereof which is the hottest part.

The principles
of generation.

The place of
Conception.

Neither are Males generated onely in the right side, but also out of the right side. For so saith *Hippocrates* in his Bookes *Epidemion*; when a man begins to grow lustfull, if his right Testicle swell, he will beget a manchild, if his left a woman. And thence also it is that he calleth the right Testicle *Masculum* the male, and the left *Famineum* the Female, because the seede of the one is very hot and exquisitely boyled and made of the purest blood, that of the other colder and thinner, hauing much whey in it because of the originall of the left spermatall veine out of the emulgent. This the Countreymen know full well, and therefore when they would haue Cow-calues, they tye the right Testicle of the Bull, that the seede may onely yssue from the left; which they learned, or might haue done, from *Hippocrates* in his book

The place out
of which the
Infant is Con-
ceived.

De

De superfætatione, where he sayeth, *When you would engender a Female, tye the right Testicle of the Male; when a Male, tye the left.*

The Conformation.

If wee respect the *conformation*, or conformation of both the Sexes, the Male is sooner perfected and parturated in the wombe; for he is accomplished the thirtieth, the Female not before the 40. day, as wee haue before noted out of *Hippocrates* in his first Booke *de diata, de natura pueri & Epidemion*: but conformation is the worke of heate. So likewise the Male is moued sooner, that is the third moneth, the Female later, that is the fourth; beside the motions of the Male are more frequent and more violent, all which are manifest signes of an abundant heate. Adde hereto that the Male borne the seuenth moneth commonly suruiue, the Female seldom or neuer.

The Lochia.

That also which is auoyded after the Infant is borne into the world called *Lochia* doeth testifie the heate of a male childe: for the woman which is deliuered of a Female is longer in her purgations, of a Male shorter, because the Male being hotter spendeth more of the bloud gathered together in the wombe. This *Hippocrates* teacheth in playne tearmes in his Booke *de morbis mulierum*: *After the birth of a mayde (sayeth hee) the longest purgation lasteth 42. dayes, but after the birth of a knaue childe (so our Fathers called a Male) the purgation lasteth as the longest but 30. dayes.*

The habit and structure.

If we consider the habite & structure of the parts of both sexes, you shall finde in men more signes of heate then in women. The habit of a woman is fatter, looser and softer; but fat is not generated but by a weake heate; woemen are also smooth without hayre. The flesh of men is more solide, their vessels larger, their voyce baser: now it is heate which amplifieth and enlargeth, as cold straitneth and contracteth.

A woman sayth *Hippocrates* in the 43. Aphorisme of the seauenth Section, is not *Ambi-dextra*, that is, cannot vse both hands as well as one, because she wanteth heat to strengthen both sides alike.

The diet.

In diet also, that is, in the custome and vsage of their liues in meat and drinke and such like, men appeare to be hotter then women.

Hippocrates in his first Booke *de diata*, *Men doe liue a more laborious life, and eat more solide meates then women, that they may gather heate and become dryer, woemens foode is more moyste;* and beside, they liue an idle and sedentarie life, pricking for the most part vpon a clout.

The finall cause.

Finally, to all these we may ad the necessity of the Finall cause which is in Naturall things the chiefe of all causes: It behoued therefore that man should be hotter, because his body was made to endure labour and trauell, as also that his minde should bee stout and inuincible to vndergoe dangers, the onely hearing whereof will driue a woman as wee say out of her little wits. The woman was ordayned to receiue and conceiue the seede of the man, to beare and nourish the Infant, gouerne and moderate the house at home, to delight and refresh her husband foreswunke with labour and well-nigh exhausted and spent with care and trauell; and therefore her body is soft, smooth and delicate, made especially for pleasure, so that whosoever vseth them for other doth almost abuse them.

The Conclusion.

Wherefore we conclude, that if you respect the principles of Generation, the place, conformation, motion, birth, purgations after birth, the habit of the whole body, the structure of the parts, the manner and order of life, and the finall cause of Creation, you shall finde that in all these respects a man is hotter then a woman.

If our aduersaries will not yeelde to all these demonstratiue arguments, let them at least giue credance to the whole Family of the Grecians both Philosophers and Physitians.

Authorities to proue men hotter.

This *Hippocrates* before the birth or incarnation as we may say of Philosophy, with a diuine spirit declareth, not darkely and obscurely but in plaine tearmes, in his first Booke *de diata*, after this manner: *Generally and vniuersally men are hotter and dryer then women (for we insist vpon mankind) and women moyster and colder then men.* That Genius and interpreter of Nature *Aristotle* in his Booke of the length and shortnes of life, sayth, *that men liue longer then women because they are hotter.* In his third Booke *de partibus Animalium*, men are stronger and more conragious. In the first and eight Chapters of the first Book of his Politicks, men in all actions are more excellent then women; surely because of their heate from whence cometh the strength of the faculties. And in the 29. Probleme of the 4. Section, he enquireth why men in winter are more apt for Venus and women in summer; hee answereth, because men who are hotter and dryer are in Summer spent as it were and broken; and women in winter because they are cold and moyst and haue little store of heat, and their humors as it were frozen or curdled, not fluxible and moouing.

Aristotle.

Galen

Galen in a thousand places establisheth this truth, but especially, in the sixth chap. of his 14. Booke *de usu partium*, where hee saith that women are more imperfect then men, because they are colder. For indeed of all qualities heate is the most operative.

Hence therefore we conceiue that it is manifest to all men who list to vnderstande the truth, that men are vniuersally hotter then women, and that those that maintaine the contrary are Apostataes from the ancient and authentick Philosophy. But because wee may seeme not fully to satisfie men by our reasons and authorities, vnlesse we answer the arguments brought and vrged on the contrary part, we will a little paine our selues and the Reader to answer them in order.

To begin therefore with the authority of *Hippocrates*, because it is a kind of wickednesse not to subscribe vnto this Father of Physicke, we will interpret his words by their force or power.

Whereas therefore he saith, that a woman hath rarer kinde of flesh then a man, we answer, that he vseth the word *Rare* abusiuely or at large for that which is lax and soft, not for that which is porous. For if we so vnderstand it, the body of a man is more rare, that is, more porous and open, and therefore they sweate more freely and more easily. And that this is *Hippocrates* meaning we appeale vnto himselfe in his Booke of Glandules, where hee saith: *It is therefore manifest, that the Chest and Paps, and the whole body of a woman is lax and soft.* And a little aboue, *A mans body is full, and like a cloath, thicke and tight both to see to and to feele to, but a woman is rare, and lax, and moyst, both to see to and to feele to.* Now laxity argueth a defect of heate which is not able to boyle and dissolue the superfluous moisture; on the contrary, solidity and fastnesse of the flesh ariseth from the perfect assimilation of wel boyled and resolued Aliments, yet is it also rare, that is, porous. Wherefore seeing the flesh of men is more solid then that of the woman, it followeth necessarily that they are also hotter.

And whereas *Hippocrates* saith, that women draw more aliment then men: Hee also abuseth the word *Traction* for that which is to receiue and conteyne. For the bodye of a woman being looser and as it were spongy, receyueth and conteyneth a greater quantity of blood. And that this is *Hippocrates* meaning, I gather from the Context of the place cited. For he illustrateth his opinion by an elegant similitude. If (saith he) you lay out all night vpon the ground the like waight of wooll, and a well wouen cloath; you shall find in the morning the wooll to waigh heauier then the cloth, because it hath sucked vp more moisture: so it is reasonable that the lax and loose flesh of women doth receiue and retaine a greater quantity of blood then the solid flesh of a man.

And whereas in the same place it followeth, that the blood of a Woman is hotter then the blood of a man, and therefore a woman of a hotter temper then a man; that we thinke is crept into *Hippocrates* text, being added by some Nouice scribe. And thus that great Learned man *Ludouicus Duretus* vnderstandeth *Hippocrates* and conceyueth of this corrupted place; as also *Christophorus a Veiga* in his Commentaries vpon *Hippocrates* Prognostiques. Wherefore wee cannot admit of *Cordanus* his interpretation, who thinketh that the blood suppressed, because transpiration is hindred, attaineth an outward and Aguish heat, and so becommeth hotter then the blood of men. For then wee must needs accuse *Hippocrates* of folly, (which were a kinde of blasphemy) because he compareth a sick woman with a sound and haile man. But if you compare the blood of both sexes diseased, the heat of a man will certainly be more intense then that of a woman, because it is ioyned with ficcity. Now *ficcity* (saith *Auerrhoes*) is the file of heate: And thus we suppose that wee haue satisfied the authorities out of *Hippocrates*. Now let vs waigh the arguments with as much diligence as we may.

Womens pulses are more frequent and swift, therefore they are hotter; for the swiftnesse or frequency of the pulse commeth from heate. Wee answer, that their pulses are more quicke and frequent, not because of the abouundance of heate, but because of the straightnesse of their organes. For the Arteries beeing small and narrowe, and oppressed with a-bouundance of crude and colde humours, could not bee so extended and dilated as in men; wherefore the necessity of life maketh recompence in the quicknes and frequency of the pulse; Nature prouiding for her selfe one way, when shee cannot another. But the pulses of men are strong and great by reason of the strength of the faculty, because a great Artery may be extended into all dimensions which a small vessell cannot be.

That which is objected concerning the two faculties of the heart, the *Irascible* and the courage, we thus dissolue: In *Hippocrates* and *Galen* *ὀργή* and *θυμός*, that is, *Iracundia* and

The Conclusion.

Answer to the Authorities.

Hippocrates expounded.

An excellent Similitude.

A place of *Hippocrates* corrupted. *Duretus*, *Veiga*.

Cordanus interpretation of the corrupted place rectified.

Auerrhoes.

Answer to the former Argument.

Why Women haue quicke Pulses.

Ira, Anger and Wrath are two distinct things. Anger is a disease of a weake mind which cannot moderate it selfe but is easily inflamed, such is in women, children and weake and cowardly men; and this we tearme fretfulnesse or pettishnes: but Wrath which is *Ira per-*
manens belongs to stout hearts, and therefore *Homer* calleth *Achilles* Anger: *ἄντι*.

Homer.

Iliad. u. Μῆνιν ἄειδε θεὰ Πηληϊάδεω Ἀχιλῆος.

O Goddesse sing the fixed rage of *Peleus* wrathfull Sonne.

Galen.

And *Galen* in his second Commentarie vpon the first Booke *Epidemion* opposeth *ἔν-
 θυος* *Iracundos*, angry men, *θυμώδεις* to wrathfull men; because these latter are of a manly
 courage and contemners of base things, the former are faint hearted or white Livered as we
 vse to tearme them. And the Temper of these two sorts is very different; for those that are
 angry, pettish, fretfull or wantle, chuse you which you will call them, are cold; but those
 that are wrathfull are hot. If therefore women be Nockthrowne or easily moued off the
 hinders, that they haue from their cold Temper and from the impotencie and weaknes of
 their mind, because they are not able to lay a law vpon themselves.

*Galen inter-
 preted by
 Hippocrates.*

And whereas *Galen* in his Booke *de arte parua* maketh *ἔνθυος* to be a signe of a hot heart,
 he abuseth the word. For *Hippocrates* in the fourth Section of the sixt Booke *Epidem.* ma-
 keth it a signe of a cold habit in expresse words, where he sayeth, *Those that haue hot bellies
 haue but cold flesh, such are thinne and veynie, and ἔνθυμώδεις* that is, angry or fretfull. Women
 therefore are peuis creatures most what, but nothing stout or strong hearted, though their
 stomacks be good. *Hippocrates* in his Booke *de morbis virginum* hath this saying, *ἀθυμώτερον φύσιν
 ἢ ἄνδρῶν*, The Nature of a woman is to be of an abiect minde.

Why females
 are fierce.

And whereas they contend that among rauinous Creatures the Females are most
 fierce, we say that the loue they beare to their yong addeth spirits and courage vnto them,
 and therefore that is rather to be accounted woodnes then fortitude. There are some cre-
 atures which because of their giddy madnesse make a shew of generosity, as the Female
 Elephant: some also there are in whome the feare of a worse condition begetteth boldnes,
 such are Panthers. In a Dogge partly his trustinesse to his maister partly his enuy maketh
 him fierce. We say therefore that Females are more churlish and fierce, but not stouter or
 stronger hearted. That which is objected concerning the strength of their naturall faculties
 is of all the rest the most friuolous and vaine.

Why women
 grow faster and
 be ripe sooner
 then men.

They say that women grow faster and doe sooner generate, and therefore they are hot-
 ter; but we say, that these are demonstratiue signes of a cold temperament. For therefore
 they grow faster and ingender sooner, because their end is nearer, for that the principles of
 their life are weaker. For as a short disease which we call *Acute*, doth suddenly run through
 his foure times; the beginning, the encrease, the height, and the declination, so that one time
 ouertaketh another; so women being of a shorter life then men, because they are colder, they
 sooner grow women, and so also sooner grow old then men. And hereto subscribeth *Aristotle*
 in the sixt Chapter of his 4. Booke *de generatione Animalium* where he saith, *That all things
 that are lesse and weake, as well in the works of Art as of Nature, doe sooner attayne vnto their end.*

Why females
 are lasciuious.

That Females are more wanton and petulant then Males, wee thinke hapneth because of
 the impotencie of their minds; for the imaginations of lustfull women are like the imagi-
 nations of brute beastes which haue no repugnancie or contradiction of reason to restraîne
 them. So brutish and beastly men are more lasciuious, not because they are hotter then o-
 ther men, but because they are brutish. Beastes do couple not to ingender but to satisfie the
 sting of lust, wise men couple that they might not couple.

That womens Testicles are hidden within their bodies is also an argument of the cold-
 nes of their Temper, because they want heate to thrust them forth. Yet for all this we doe
 not say that women do generate more then men, for they want the matter and the spirit.
 Indee they haue more blood as wee sayed euen now, and that is by reason of their colde
 Temperament which cannot discusse the reliques of the Aliment; adde heereto that the
 blood of women is colder and rawer then the blood of men. Wee conclude therefore that
 vniuersally men are hotter then women, Males then Females, as well in regard of the Na-
 turall Temper, as that which is acquired by diet and the course of life.

But now I had need heere to Apologise for my selfe for speaking so much of woemens
 weaknes; but they must attribute something to the heat of disputation, most to the current
 and streame of our Authours, least of all to mee who will bee as ready in another place to
 flourish forth their commendations as I am heere to huddle ouer their naturall imperfe-
 ctions.

QUEST.

QUEST. III.

what Seede is.

HAuing thus discoursed of the difference of the Sexes the first thing necessary to Generation, it followeth that we intreat of the Seede which is the immediate matter of the same. To this common place we may well giue the same Epithete which *Homer* was wont to giue to those places which were scituated vnder montaines, which hee calleth *πολυιδαναι*, that is, hauing many springs of liuing water. For I doubt not but the Reader shall finde it full of pleasure and contentment, full of variety and of pleasant philosophicall flowers, especially if I can acquit my selfe well in gathering them, and if they loose not their verdure and saueur now transplanted into a strange soyle. That I may therefore take euery thing in order, it wil not be amisse first to informe you what the worde it selfe in the originall signifies.

Τὸν δὲ σπέρμα, *semen* and *genitura*, Seede and Geniture, among Physitians are taken for one and the same. *Hippocrates* intituled his Booke of Seed *περὶ γόνος*. And *Galen* his *περὶ σπέρματος*. And *Hippocrates* in many places of the same Booke calleth it also *σπέρμα*, as where hee sayeth *καὶ ἐν τῷ ἀνδρὶ τὸ θηλυ σπέρμα καὶ τὸ ἀρσεν, καὶ ἐν τῇ γυναικὶ ὁμοίον*. There is as in a man so in a woman male & Female Seede. And *Galen* in his Commentary vpon the 62. Aphorisme of the first Section *σπέρμα ἰνομάζομεν καὶ γόνον καὶ γόνον*, We call Seede Geniture. *Hippocrates* also for the same useth *θόρος* in his second Booke *de Morbis*. But *Galen* in his Commentarie in 1. *Prognost.* distinguisheth betweene *θόρος* and *σπέρμα*, where he saith that *θόρος* signifieth rather the excretion of Seede. *Aristotle* in the 18. Chapter of his first Booke *de Generatione Animalium*, putteth a difference betweene Geniture and Seede, as if Geniture were *ens imperfectum*, an imperfect thing, and onely one principle of Generation, but Seede perfect, compounded of both principles. For our part we wil take them promiscuously, although the name of seed be more frequent and in more ordinary vse.

The Nature of Seede no man that I know hath yet essentially defined; *Hippocrates* in his Booke *de Genitura* calleth it, *The best and strongest part of that humour which is containd in the whole body*. *Pythagoras*, The froth of the best and most laudable blood. *Plato*, The defluxion of the spinall marrow. *Alcmaeon*, A small portion of the Brayne. *Zeno Criticus* The spirit of a man which he looseth with moisture, and the slough of the Soule. *Epicurus* A fragment of the Soule and the Body: Some of the Ancients haue defined it to be, *A hot spirit in a moisture able to moue it selfe, and to generate the same out of which it issueth*. *Aristotle* sayeth it is an Excrement. *Fernelius* describeth it on this manner. *It is that out of which originally are made all things which are according to Nature, not as out of a matter, but as out of an Efficient Principle*. But it seemeth to vs that none of all these do sufficiently expresse the nature of Seede. The five first are most imperfect, and therefore we wil not contend with them.

Aristotles description defineth onely the matter, which is the remaynder of the last Aliment; but the forme and the efficient cause it toucheth not; neither indeede doeth it expresse the whole matter of Seed, because (as we shew anone) there is a double matter of Seede, blood and spirits. So that to say that Seede is an excrement of the last Aliment, is all one as if he should haue sayed Seede is Blood. *Fernelius* definition conteyneth neyther the forme nor the matter of Seed, but attributeth to it only an operative or efficient power, whereas it is also a materiall principle: wherefore we haue here exhibited another definition perfect we hope and absolute in all his members and parts, which is this:

Seede is a moist, spumous or frothy and white body, made of the permission of the surplusage of the last Aliment & of the influent or errant spirits, boyled & laboured only by the vertue of the Testicles, and that for the perfect Generation of a Creature. We already in this Book a little before examined the singular particles of this definition, which we shall not therefore need to run ouer againe; here we wil onely prosecute a little more curiously the matter of Seede.

We therefore say that there is a double matter of Seede, the Excrement of the last Aliment, and Spirits. That this first matter is an Excrement, *Aristotle* prooueth by an elegant induction, on this manner. Whatsoeuer is containd in the body eyther is a part of the body, or an Aliment, or a Colliquation, or an excrement: Seede is not a part of the body, nor an Aliment, nor a Colliquation, and therefore an Excrement. It is not a part, because whilst it remaineth in vs there is nothing made of it, neither hath the body any vse especial-

The names of seed.

Hippocrates.
Galen.
What *θόρος* is.

Aristotle

Hippocrates.
Plato.
Alcmaeon.
Zeno Criticus.
Epicurus.

A definition of the ancients.
Aristotle.
Fernelius.

All disallowed.

A perfect definition of seed.

The matter of seede double.

ly of the matter of it. Adde heereto, that if it were a part, so often as it is lost the creature should become maimed.

No Aliment.
No Colliqua-
tion.

It is not an Aliment for then it should not be auoyded, much lesse is it a Colliquation. For a Colliquation is a thing beside Nature, feede is truly naturall yea the quintessence of the Nature of man. Those things that are fat are most subiect to Colliquation or melting, but we know that fat men haue least quantity of feede. Moreouer Colliquation may bee made of any moisture in any part of the body, but the feede hath his owne determinate and limited seate wherein it is contained. Colliquation is alwayes hurtfull, but the auoyding of feed is sometimes very profitable.

But an excre-
ment.

It remaineth therefore that feed must needs be an excrement. But what manner of excrement is it? In all creatures that bring forth their young alieue there is a double excrement. The one naturall and profitable, the other vnprofitable. The first is profitable either to nourish some part, or to procreate, conceiue and breed vp the young, as *Galen* teacheth in his Commentary vpon the 39. Aphorisme of the fift Section; the other cannot bee assimilated because it is of a dissimilar substance. The first is called an excrement onely by reason of the abounding quantitie thereof. The second is noxious and hurtfull euen in qualitie also.

Excrements
double.

What is a pro-
fitable excre-
ment.

The Chylus which is made in the stomacke is acceptable euen to the stomacke which is pained about the concocting thereof, but at length it is thrust down into the gut as an ouerplus or superfluity; so that which was an excrement to the stomacke becommeth to the Liuer an Aliment. The Liuer being satisfied and glutted with blood, drives that which remaineth as a surplusage into the great veines, so the excrement that is, the superfluity of the Liuer, becommeth a conuenable aliment for the particular parts. The parts both fleshy and solid when they are satisfied with blood, do leaue that which remaineth in the veines; these reliques are by little and little drawne by the Testicles and at length are conuerted into the nature of feede. And for this cause the feede is called an excrement of the last concoction, because it is generated out of the remainders of the last Aliment. That remainder is blood, not changed or whitened by the solid parts, for the feede hath his whitenesse onely from the spermatice vessels and the Testicles; but redde and pure blood deriued from the trunk of the Hollow veine into the spermatice veines. An argument heereof is, because children and decrepit old men do not yeeld feed, for that in them there is no ouerplus left; and such wantons as doe too immoderately satisfy their inordinate concupiscence do often yeeld bloody feed, because it is not altered by the spermatice vessels and the testicles.

How euery
part ministe-
reth to ano-
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dance.

How feed be-
comes white.

The second
matter of the
feed.

There is another matter of the feede fare more noble which maketh it prolificall or fruitfull, and that is Spirits brought vnto it by the spermatice arteries, which being fierie and aery substances wandering and coursing about the whole bodye, doe containe in themselues the Idea or forme of the particular parts. Neither do these spirits onely containe the forme of the sexes, but also *ἡ ἀναγκαῖα μορφή* the fatall necessity of life and death; so that from whence we haue the acte of life, from thence also we haue the necessity of dissolution.

In regard of these spirits the feede is called an efficient and a formall principle. For the spirit is the immediate and proportionable instrument of Nature, wherby the noble Architect, that is the soule, extendeth the Membranes, produceth and lengtheneth the passages, and by a kinde of puffing sufflation perforateth them.

The double
Nature of
feed.

This therefore is the double matter of feede, blood and spirits. Hence it is that among the Philosophers the feede is esteemed to haue a double Nature; one aery, spumous or frothy; another waterish and diffuent. For in that the feede is aery it is neuer congealed or frozen, and in that it is waterish, it is no sooner out of his owne vessels but it melteth, the spirits being vanished which did vnite his parts.

How feed and
water differ,
Aristotle.

Now, whereas there are some which affirme that feed is onely waterish, because the colour is like water, as also the consistence when it hath bin but a little time out of the vessels; we will against them oppose *Aristotle* who disputeth this very point in the second chapter of his second Booke *de generatione Animalium*, where he saith, that the natures of water and feede are very different, for water by heate becommeth not thicke as feede doth. All waterish things by colde are congealed, feede is made more fluid. And in the 51. Problem of the first Section he saith, that feede is like to Flegme and water, not in Nature but onely in colour. But we proceede.

This double matter is mingled in these Labyrinths in which the veine openeth into the artery, and the artery into the veine by a wonderfull inoculation, so that of two there becommeth

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commeth one vessell; an Embleme of the holy mixtion of feedes in Matrimony. For as of two vessels a veine and an artery there is made one vessell, so of a double matter blood and spirits there is made one seed, and of two seeds the Males and the Females one infant, and of two parents the husband and the wife one body.

An Embleme
of Matrimony

The blood and the spirits being thus mingled do attaine in the preparing vessels a rudiment of feede, not so much by the inbred power or faculty of the vessels themselves, as by an irradiation or beaming influence they haue from the Testicles. Finally, in the *Epididymis* and the Testicles the seed is boyled by their proper and ingenit vertue whose substance is rare, spongy and friable; and from these it is deriued into the eiacularatory vessels as an ouerplus and peculiar excrement of the Testicles. From whence it is manifest that fruitfull and prolificall seede yssueth onely out of the Testicles not from the whole body, as we shal further prooue in our next exercise.

How this mixture becometh seede.

QVEST. IIII.

Whether seede fall from all the parts of the body.



He thinkes now I see a faire and large fielde before me, wherein I may expatiate and disport my selfe a little, not restraining my discourse within those narrow cancels wherein I haue formerly confined it. It was a common receyued opinion in old time, that the seede did flow from all parts of the body. This *Hippocrates* auoucheth in his book *de genitura, de morbo sacro* or of the Epilepsie, & *de aëre, aquis & locis*, for there he saith That seede yssueth from all moysture which is contained in the body. And in another place, *Seede falleth from all the parts, sound seede from sound parts, and sicke or diseased from diseased parts*. Hence it is, that lame men beget lame children, bald men bald children, and Spleniticke men children afflicted with the Spleen. This opinion is confirmed by foure reasons. First because, in the acte of Generation or Copulation the whole body is delighted and as it were stupified with an extasie of pleasure, or if you will, suffereth a pleasant Convulsion. Whence it was that coition is called *parua Epilepsia*, a light Fit of the Falling sicknesse, as we saide euen now.

The olde and receyued opinion.
Hippocrates.

Confirmed by
foure reasons.

The second reason is, because the Childe beareth the Character of the Fathers imperfections: Balde men, balde children; Lame men, lame children, and so likewise in all the Cense of Hereditary diseases.

Thirdly, because those that are immoderate in the vse of *Venus* doe waste and consume all the parts of their bodies. Finally because children do resemble their parents in all parts of their bodies. There is an elegant History of a Boy in *Chalcedon*, who bare in his right arme from his birth certaine markes which were seated before in his Fathers right arme also.

An elegant
history.

But this opinion is gainsayed and disprooued by *Aristotle* in the 17. and 18. chapters of his first Book *de generatione Animalium*, and that with weighty arguments which we list not heere transcribe. *Fernelius* also in the seauenth Booke of his *Physiologia* and the second chap. addeth other reasons, to which we referre the studious Reader. It shall suffice vs in this place to answere the former arguments.

Aristotle.
Fernelius.

The argument drawne from the vniuersall pleasure and tickling delight of the whole body is of no force; for euen in itching the whole bodie is tickled, though onely one part itcheth. Moreouer, if the pleasure were therefore conceiued because the seed floweth from the whole body, it should not be perceiued in all the body at once but by degrees, first in one part then in another as the seede fell from this or that part. For we cannot imagine that in one moment of time seed is deriued from all the parts into the Testicles, and so into the eiacularatory vessels. Wee therefore acknowledge another cause of that pleasure whereby the whole body is delighted in Coition, to wit, the high heate, froathinesse and abundant spirits of the Seed; for that Seed so qualified, as it tickleth the parts of Generation which are of exquisite sense with his suddaine motion, it draweth the whole bodye into a sympathy and consent with them. For as if a Membrane be affected any way with paine, all the Membranes of the body conceyue a sense of dolour therewith: so when a Membrane is tickled, the whole body receyueth a sense of delight and is likewise moued therewith.

The former
arguments
answered.

Why all the
body is tickled
led in coition.

That lame men beget lame children, or maymed maymed is not perpetually true, for we see oftentimes that lame men beget perfect children, and hee that wanteth a ioynt begetteth a childe with all his ioynts.

That in immoderate coition the whole body is resolu'd and consumed, happeneth because the remainders of the Aliment and the Spirits are in such men exhausted, whereof when the parts are defrauded then they must of necessity waste and consume. And therefore *Anicen* sayeth, that the great expence of Seede wasteth the bodye fortie times so much as the expence or loosse of blood, if the losse of them both bee proportionable.

Finally, that which they obtrude concerning the likenesse of Childeren to their Parents belongeth to a higher contemplation, and shall bee disputed at large by and by in a more conuenient place; yet thus much in the meane time we say for answer, that the similitude they speake of proceedeth not so much from the crasse and thicke matter of the Seede; as from the formative faculty seated in the particular parts, and communicated to the Testicles, and at length to the Seed by the influent Spirits which are neare of kinne vnto those which haue their perpetuall residence in the parts of the body.

Wee therefore doe protest against that old error as a beggerly rudiment receiued from hand to hand among the Auncients, that the Seede falleth from all the parts of the body.

Another opinion of those that deriue the seed from the braine.

Some there are who deriue the greatest part of the Seede from the Brayne and the Spinal marrow. This opinion of theirs I will illustrate by authorities, examples and reasons. The authoritie is that of *Hippocrates* in his Booke *de Genitura*, where he sayeth, that the Seede is diffused out of the Brayne into the Loynes and the marrow of the backe, from thence into the Kidneyes, from the Kidneyes it attayneth through the middle of the Testicles to the priuy parts. In his Booke *de Natura ossium*, hee wryteth that the Ingular veynes proceede from both sides of the head into the Testicles, and thither conuay the Seede, wherefore from the Brayne to the Testicles, *Hippocrates* sheweth a double way, the spinall marrow, and the veines behinde the eares.

Authorities to proue it.

Plato in his *Timaeus* defineth Seed to be *A defluxion of the spinall marrow*. *Alcmaeon*, *A small portion of the Brayne*; whence it is that the common people thinke that the braines and marrow of the bones do engender much seede.

Histories.

For the confirmation of this opinion, there are elegant Histories in *Hippocrates* Booke *de aëre, aquis et locis*. The first is of such men as were called *μακροκεφαλοι*, the other of the Scythians.

Macrocephali what they are.

There were in tymes past among the inhabitants of *Europe* certayne men called *macrocephali* who were had in great esteeme, whose heads were long, and such were accounted noble and generous spirits. And therefore the Nurses were wont to presse the tender heads of Infants and to lengthen them with swathes, till at length those that by custome and constraint had long heads, begat children with long heads naturally and by conformation without any constraint at all.

The Scythians cut the veines behind the eares.

The Scythians hauing no skill at all in our kinde of Horse-manshippe, and riding without stirrups, grew all of them almost to be troubled with the Hipgout or sciatica, which disease to cure, they caused the veines behind their eares to be opened, which being cut asunder they after proued barren, and some thought this came to passe because the cicatrice or scarre closed vp the way of the seede descending from the Brayne. To which conceit a wise Lawyer, it may be alluding, wrote that Theeues should haue their eares cutte off least they should beget young Theeues. They conclude therefore that the greatest part of the fruitfull and best concocted seede falleth from the Brayne and the spinall marrow. This also may be confirmed by some sleight reasons.

Reasons to confirme this opinion. *Hippocrates*.

In coition the Brayne is chiefly affected; next the spinall marrow and the veines; and oftentimes as *Hippocrates* obserueth in his Books *Epidemion*, and *Lib. de internis affectionibus*, vpon the immoderate vse of Venus there followeth *Tabes dorsalis* - a consumption of the marrow of the backe.

A story out of *Albertus Magnus*.

Albertus Magnus maketh mention of a petulant and lasciuious Stage-player, whose head when he was dead was opened, and there was found but a little part of his Brayne left, the rest forfooth was consumed vpon harlots. Adde hereto, that vpon immoderate vse of women followeth baldnesse; now baldnes we know commeth from the want of a hot and fatty moysture, which kinde of moysture is spent in coition. And *Aristotle* saith that no man growes bald before he haue knowne the vse of Venus. This was often cast in *Caesars* teeth when

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when he triumphed ouer the *Galles*: *Citizens keepe vp your wines, for wee bring home a bald Letcher*. And these are the authorities, histories and reasons whereby some are perswaded to thinke that the seede floweth from the head vnto the testicles: concerning this matter we will be bold to speake freely.

I confesse that *Hippocrates* had a most happy and diuine wit, which, as sayeth *Macrobius*, *would neuer deceiue any man, nor could it selfe be deceiued*. Yet herein hee hath neede to be excused, and no maruell; for in his age the Art of dissection was but rude, scarcely knowne to any man, and therefore it is that many of his sayings concerning Anatomy wee cannot either vnderstand or giue consent vnto. Sure wee are that there are no manifest or conspicuous passages as yet found from the Brayne and Spinall marrow to the Testicles, vnlesse haply some small nerues which carry onely spirits but are not capable of seed: neyther yet doe we finde any branches deriued to the Testicles from the externall iugular veines, vnlesse as all the veines of the body are continued one with another: we therefore cannot conceiue how thicke and well laboured seede should passe into the Testicles from those veines which run behind the eares.

The Story of the Scythians which they obiekt, who grew barren vpon the cutting of the veines behinde their eares is of no force; for they vnderstand not aright the cause of barrenesse. Some thinke that the Cicatrice or scar which grewe vpon the wound did shutte vppe the wayes of the seede. *Auiscn* thinketh that it came to passe because the descent of the Animal spirit was intercepted; others thinke that the arteries were cut, and so the passage of the vital spirit hindered: but these are fond assertions and sauour little of any knowledge in Anatomy; for those veines and arteries which lye behinde the eares are externall vessels. There are farre larger vessels internall, which runne into the Brayne through the holes of the skull, by which as by riuierets the brayne is watered, and by which rather then by these outward which touch not the brayne at all, the seed should fall from the head. But let vs grant that the seede falleth through these outward veines; shall we thinke that a scarre will hinder the passage, or interclude the wayes of the seede and the spirits? by no meanes. For if thicke bloud floweth and returneth through these vessels notwithstanding those hindrances, why should not the seed passe also which is full fraught with spirits and will passe through insensible pores? Wee must therefore enquire further for the cause of this sterility or barrenesse, and not impute it to the interception of the wayes. I finde in *Hippocrates* three causes of this their sterility; their much riding, their sciatica payne, and the too great effusion of bloud vpon the cutting of those veines. Continuall riding weakneth the strength of the loynes, the kidneis and the spermatick parts: now the Scythians did vse to ride perpetually and without stirrups.

That much riding may be a cause of barrenesse, *Hippocrates* sheweth in the place before quoted, where hee sayeth: *Amongst the Scythians the richest and most noble were most of all others thus affected, the poorer sorte least of all; for the noble spirits because they used to ride much incurred these mischiefes, whereas the poorer sorte went on foot*. From their frequent riding proceeded also their hip-gouts, which is the second cause of sterility. For nothing so much infirmeth and weakneth the body, and to weaknes addeth the corruption of the humors, as payne.

This payne that they might mitigate they cut the veines behinde their eares, out of which issued great abundance of bloud. And hence came the third cause of their sterility, for by the loofse of much blood which is the very treasure of Nature, theyr Braynes weere ouer cooled.

Now the Brayne is a principall part, into consent wherewith the Heart and the Liuer were eftsoones drawne: and hence came it to passe that their Seede was waterish, barren and vnfruitfull. For the principall parts are all of them knitte and tyed together in so great and in so strayght bandes of conspiration, that but one of them fayling, or faltering, both the other are sodainly deaded or be-numbed and their vigour and strength quite abated.

That their Braynes were refrigerated by the immoderate effusion of blood, *Hippocrates* playnely declareth in these wordes: *When the disease beginsnes to take hold of them, they cut both the weynes which are behinde their eares. And presently after abundance of blood yssuing forth they fall asleepe for meere weakenesse*; by which it appeareth that the cause of their barrenesse was not the closing vp of the passages, but their inordinate riding, the paine of the Sciatica

Casars dis-
grace.

Hippocrates
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How the Scy-
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3. Causes of
their barrenes
out of
Hippocrates

Much riding
may cause
barrenesse.

So may payne;

And large ef-
fusion of bloud

Hippocrates

Sciatica and the refrigeration of the braine by the immoderate effusion or expence of blood and so consequently of spirits.

The obiection
of the *Macro-*
cephali answered.

That which they obiect concerning the *Macrocephali*, doth indeede prooue that the Formative Faculty yssueth from the braine vnto the Testicles, but it dooth not prooue that white and perfect seede descendeth thither from aboue.

Why the brain
is most affected
in coition.

And whereas in coition the braine and the spinall marrow are especially affected, that commeth to passe, say we, because their soft substance is soonest exhausted, and doth lesse resist the traction of the Testicles. Add heereto, that the braine is the last part wherein the traction of the Testicles doth rest and determine and therefore most affected therewith.

Empedocles
opinion.

Galen in the third Chapter of his second Booke *de Semine* writeth, that *Empedocles* doth not thinke that the seed fell from the whole body, but half of it from one parent, halfe from the other: the more excellent parts from the Father, and the more ignoble from the Mother. But it were time ill spent to insist vpon the answering of such idle conceits.

The opinion
of others.

Some haue beene of opinion, that white seede falleth from all the solid parts, passing from them into the smaller veines, out of the smaller into the greater, and in them rideth in the humors as a cloud or sediment in the vrine, and so is drawne away by the ingenite traction of the Testicles. These men *Aristotle* elegantly confuteth in the places before cited, and *Galen* in his Bookes *de Semine*.

Confuted by
Aristotle.

Auicenn opinion.

Auicenn the Prince of the Arabians contendeth, that the matter of the seede falleth vnto the Testicles from the three principall parts of the body, the braine, the Heart and the Liuer, and him haue many of the new writers followed. Neither were the Poets ignorant of this kind of Philosophy, but least it should grow common or be profaned by the rude vulgar wits, they cloaked it vnder obscure and blacke veiles and shaddowes of fables, as they would do a holy thing. For they thought it a great wickednesse and not to bee expiated, if the secrets of Philosophy were bewrayed to the common people. Wherefore they feigne that when *Venus* and *Mars* were in bed together, they were deprehended or taken in the manner, as wee say, by *Mercury*, *Neptune* and *Apollo*. *Apollo* with his rayes as with a quickning Nectar illustrateth them. Now by *Apollo* they meane the heart, whose affinitie with the sunne is so great, that they call the Sunne the heart of the world, and the heart the sunne of the body. *Neptune* the God of the Sea and the ruler of all moisture resembles the Liuer which is the fountain of benefical moisture. Vnder the name of *Mercury* that witty and wily God they designed the braine. These three principles therefore respect *Mars* coupling with *Venus*, that is, haue the ruling power in procreation.

An Elegant
Mythologie.

Thus haue you heard the diuerse and different opinions of the ancients and late writers concerning this matter, it remaineth now that wee resolute vpon something our selues, which we will do on this manner.

What wee re-
solve of.

The seed is a moyst, spumous and white body, compounded of a permixtion of blood and spirits, laboured and boyled by the Testicles, and falling onely from them in the time of generation, or from the adiacent parts. Neither do we ascribe that faculty which they call *σπέρματος ποιητικὴν* the Faculty of making seede to any other part saue onely to the testicles and their vessels. But whereas there is a double matter of the seede, blood and spirits; we thinke that the blood is red and not at all altered by the solid parts, and so falleth onely from the veines. As for the spirits which are aery, thinne and swift Natures, wandering through the whole body being neere of kin vnto the ingenite spirits of the particular parts, we thinke they fall into the Testicles out of the whole body, and bring with them the Idea or forme of the parts and their formative faculty. And in this sense haply it may be saide, that the seede falleth from all the parts of the body, but in no other.

Obiection.
Answers.

But some man may say, If the seede yssue onely from the Testicles, how may it bee that two so small bodies as the Testicles are, should be able to boile so great a quantity of seeder? I answer, that heerein appeareth the wonderfull wisdom and prouidence of the God of Nature, who hath made all official parts, not onely to draw fit and conuenient Aliment for their owne vse, but so much and so great a quantity as may suffice the other intentions of Nature also. So the Liuer draweth more blood out of the Veines of the Mesentery then is sufficient for his owne nourishment; so the heart generateth abundance of spirits; not onely for his owne vse, but to sustaine the life of all the rest of the parts. The Testicles therefore being common and official members, and the first and immediate organs of generation, do draw more blood then may suffice for their owne sustentation, which ouerplus being there arriued, is by them continually concocted and boyled into seede.

The wonder-
full prouidence
of God.

QVEST. V.

Whether women doe yeelde seede.

CONCERNING the seede of women, there is a hot contention betweene the *Peripateticks* and the *Physitians*. *Galen* in his Bookes *de Semine*, and in the 14. Booke *de usu partium*, elegantly discusseth the whole question, wherefore that which he there hath at large and in many words exemplified, wee in this place will contract and draw into a briebe summe. There shall be therefore three heads of this Disputation. First of all we will propound the reasons of the *Peripateticks*. Secondly, we will giue you a view of the opinion of the *Physitians*; and lastly we will answere all Obiections that are brought against the truth.

Aristotle in his Bookes *de Generatione Animalium* contendeth, that women neither loose any seede in the acte of generation, neither yet indeede haue any seede at all, and that for these reasons.

First, because it is absurd to thinke that in women there should be a double secretion at once of blood and seede. Secondly, because women in their voice, in their haire and in the habit of their body, are most like vnto Boyes, but boyes breede no seede. Thirdlie, because women doe sometimes conceiue without pleasure yea against their wils. For *Auerrhoes* telleth a Story of a woman who being in a Bath together with some men, receyued seed that fell from them and floated in the water, and thereupon conceiued. Fourthly, because a woman is an vnperfect male, and hath no actiue power but onely a passiue in generation. Finally, because if women should loose seed they might engender without the helpe of the male, because they haue in themselves the other principle of generation, to wit, the Menstruall blood.

On the contrary, the *Physitians* bring stronger arguments to prooue that women yeelde seede. This first of all men *Hippocrates* auoucheth in his Bookes *de Genitura* and *de diata*, where he doth not only acknowledge that women haue seede, but addeth moreouer, that in either sexe there is a twofold kinde of seede, one stronger, another weaker. *Aristotle* also himselfe in his tenth booke *de Historia Animalium* is constrained to confesse that to generation there is necessarily required a concourse of the seeds of both sexes.

Galen in this businesse hath so excellently acquitted himselfe, that he hath preuented all men after him for gaining any credit by the maintenance of this truth. Notwithstanding, we will endeauour by demonstratiue arguments to make it so manifest, as for euer all mens mouths shall be stopped.

First therefore it is agreed vpon by all men, as well *Physitians* as *Philosophers*, that Nature endeouoreth nothing rashly or vaine. If therefore there bee all the Organes for generating, boyling and deriuing or leading seede to the parts of generation in Women as in men, it must needs follow that they also doe generate, boyle and leade downe seed. Now for the preparation of seed they haue foure vessels, two veines and two Arteries, for the boyling and perfecting of seed they haue testicles, for the leading it down they haue eiacularatory vessels. And this is agreed vpon by all Anatomists.

I know well that the *Peripateticks* will obiect, that in those vessels there is conteyned a kinde of waterish moysture and serous, but nothing sufficiently boyled, and that the Testicles of women haue as much vse as the paps in men. But how miserably they are deceiued, good reader be thou iudge. If those preparing vessels do containe nothing but a whae and serous moysture, crude and vndigested, why are they contorted with so many Girations and Convolutions? why so wreathed and plighted one with another? Nature nowhere in all the body hath made any web or complication of vessels but onely for a newe coction and elaboration. Add heereto, that if these vessels do onely yeelde a waterish and serous humor, why doth the spermatieall veine insinuate it selfe into the spermatieall artery, so that of two vessels they become but one, as it is in men? Is it not rather therefore, that the double matter of the seede should be exquisitely mingled, and one body made of the permutation of blood and spirits? As for the proportion betweene womens Testicles and mens breasts, we say it is not equall. For the Pappes in men serue onely for ornament, to strengthen the chest and defend the noble parts therein contained. The Testicles of women

Three heads of this Controuersie.

The arguments of the *Peripateticks* that women haue no seed.

The opinion of the *Physitians*. *Hippocrates*, *Aristotle*.

Galen.

The reasons on the *Physitians* side.

Obiection. Answered.

That there is not the same reason or proportion in the paps of men, and the Testicles of women.

An argument
from the eia-
culatory vessels.

men vnlesse they make seede, are altogether vnprofitable. The Pappes of men haue no Glandules, neyther do they generate milke. The Testicles of women are perfect Glandules, and their substance is hollow or cauernous as they are in men. Moreover, why are the eiaculatory vessels which are inserted into the sides of the wombe, which they commonly call the horns, more intorted in women then in men, but only that the shortnes of the way might be recompensed by the variety of the complications? What neede was there of so great curiosity in this admirable worke of Nature, if it had been onely for the Generation or eiaculation of a crude and waterish humour?

Another dé-
monstration.

This demonstration we take to be strong enough and indeed not to be gayn-sayed; yet giue me leaue to strengthen it yet more with another. There is nothing more certayne then that woemen in their accompanying with men doe loose somewhat from whence comes their pleasure and delight. That therefore which is auoyded is either bloud, or a thinne and ferous humour, or perfect and laboured seed. No man in his right wits will say it is bloud; for when the courses flow there is no pleasure, no delight followes thereuppon, yea most commonly dire and terrible racking paynes. That it is not a ferous or vnconcocted humour, is conceiued by the wonderfull structure of the Preparing and by the complications of the Eiaculoric vessels. Wherefore it remayneth that it must bee something well concocted and laboured in these complications which they loose. And that is Seed, which is prooued by the white colour, the thicknesse and the spirits wherewith it is houxed and turgid.

If you dissect the organs of women which haue long refrayned the vse of men, you shall finde their vesselles and Testicles full of seede. Adde hereto that those who of a long time haue intermitted the vse of the mariage bed, or otherwise are wanton women doe in their sleepe auoyde great quantity of seede. And are not women often troubled with the *gonorrhoea* or running of the reynes and that disease which wee call *priapismus*? Yea sometimes when their genitalles are full of seede they grow into woodnesse and rage of lust, and euen to bee starke mad indeede; but after that seede is auoyded they come againe vnto themselves. Continuall experience tels vs that those Females which are castrated or gelt, will neuer admitte the vse of the Male, but the goads of lust are in them vtterly extinguished.

Another opi-
nion of some
Peripateticks.

The strength and validitie of these arguments haue driven many of the *Peripateticks* to confesse that women also doe auoyde seede, but least they should depart from the opinion of their Maister *Aristotle*, they say that that seede is vnfruitfull, hauing in it no active or operative faculty or power. So that all the active power of generation they attribute to men, comparing the man to the Artificer and the woman to the wood which hee squareth and heweth and worketh into shape or forme. The man they say yeeldeth the Soule and the forme, the woman onely the matter.

Auerroes
Albertus Mag.

The principall of this sect are *Auerroes* and *Albertus Magnus*: for, say they, whereas in euery Nature there must be a Patient correspondent and answerable to the Agent, it is most likely that the passive power is giuen to women which might answere to the active power in men. And truly to receiue the seede, to conceiue it, to beare the burthen and to nourish the Infant; are all arguments of a passive faculty.

Womens
seed is opera-
tine.

With this deuice they thinke they haue eluded and escaped the darts of the Physitians, when yet alas they wallow still in the same myre. For, to auoyde white, spumous, thicke and well concocted seede is all one as to auoyde active and operative seede. For will the spirits which are brought by the spermaticeall arteries and are exquisitely mixed with the bloude in these mazy complications, play them idlie in the conformation? Or should wee not rather beleue that the spermaticeall parts are of them generated as of their proper matter? The seed therefore of women is active as that of men, but yet it is weaker, because it is lesse hot and hath in it fewer spirits.

A strong rea-
son of *Galen*.

I will giue you a taste of one or two of *Galen*s arguments which shall manifest the foecundity and fruitfulness of womens seede.

How children
become like
their parents.

That the childe is sometimes like the father sometimes like the mother no man will deny. This similitude is either from the seede or from the menstruall bloud; not onely from the menstruall bloud, because then children should alwaies be like their mothers, neuer like their fathers; neither onely from the seede of the father, for then children should alwaies bee like the father, and neuer like the mother: the similitude therefore proceedeth from a common cause issuing from them both, which common cause is seede. The *Peripateticks* will answere that sometimes the children are neither like father nor mother, but like their grandfathers or great grandfathers, who neither actively nor passively did contribute any thing

thing to their generation. But I cannot see what they can answer to that argument of hereditary diseases.

The woman that is troubled with the Gowt bringeth forth a son subiect to the gowt, if she be subiect to the Falling sicknesse she will bring forth an Epilepticall infant, or being troubled with the Stone, a childe disposed to that disease; these diseases I hope they wil not say come by reason of the fault of the blood. For who euer was so mad to say, that the mensuall blood contained in it the Idea or forme of the particular parts? The impurity of the blood wil indeede make the childe weake and sickly; but to make a fabulous and calculous impression in the Kidneyes, or a gowtry impression in the ioyntes, is only proper to the seed, which conteyneth in it the tatall necessity of life and death.

Againe, all formation and specification (for you must giue vs leaue to vse our Schoole-terms in these matters of Art) that is, all power to set the seale or figure or difference vpon any thing, proceedeth from the seede alone. For the matter as it is a bare matter cannot change the species or forme of any thing, but the species followeth rather the Dam then the Sire. For if an Ewe be couered by a Goate, she will not bring forth a Kid but a Lamb with a hard and rugged wooll; if a Tup couple with a she-Goat, she will bring forth not a Lamb but a kid with a soft wooll, as *Athenaus* auoucheth. There proceedeth therefore from the Dam a formative Faculty, now all formative facultie as wee said is from seede none at all from the blood.

But there is a place in *Galen* which seemeth to be against vs. For in the first chap. of his 14. Booke *de usu partium* he denieth to the seede of the woman the power of procreation. A woman (saith he) because she is colder then a man, hath in her *Parastata* a thin and vnconcocted humor, which conferreth nothing to the procreation of the infant, and therefore when it hath done his office it is cast forth; but another humor, that is the seede of the man, is drawn into the wombe. We must thus vnderstand *Galen*, that in women, beside their seede, there is another waterish moysture which delighteth, tickleth and washeth their genitals; and that indeede conferreth nothing to generation, for so he saith a little after. But in the time of coition that humor suddenly and together with the seede yssueth, and therefore mooueth the sense, at other times it yssueth also by little and little and sometime without any sense at all. We conclude therefore, that women do yeeld seede which hath in it some operative or active faculty.

The vse of this seede according to *Galen* in the eleuenth chapter of his fourteenth booke *de usu partium* is manifold. First for generation, for by it as by a workman concurring together with the seed of a man, the parts are figured; and of it as of their matter the membranes are generated wherewith the infant is compassed. The second vse is to be an Aliment for the hotter seede of the man. For euery hot thing is nourished by that which is moderately cold, that is, lesse hot, as saith *Hippocrates* in his Booke *De Alimento*. The third vse is to irrigate or moisten the sides of the womb, for all the parts of the womb could not be lined or moistened by the seede of the man. The last vse *Galen* addeth, which is to open the necke of the matrix.

Argenterius derideth these vses of the seede, because nothing is nourished that doth not liue, but the seede liueth not. Againe, the seede of the woman is not eiacted into the sides of the wombe, because a womans wombe hath no hornes. But he is indeede himselfe ridiculous, endeavouring to correct *Magnificat* as wee say, when hee cannot sing *Te Deum*. Neither shall you finde any man more forward to carpe at others, then those who themselves lye most open to scorne, and disgrace, as that petulant Author doth in most passages of his workes. But for your sakes who may haply learne something by it, we will do him the honesty to answer his caills.

We say therefore, that the seed is Potentially Animated, and when it is cast into the womb that Power by the heat of the wombe is brought into an act, and therefore presently it worketh the workes of the soule; for it formeth and figurateth the parts. If then it be animated it liueth, but that life is the life of a plant. Beside, when *Galen* saith that the seede of a man is nourished by the seede of a woman, we must not be so grosse as to vnderstand him as if he meant a perfect nourishment which is made by assimilation: but because the seede of the man was hotter then the seede of the woman, it is tempered and made more dilute or fluxible by the cold and thinne seede of a woman. After the same manner we say that the spirits are nourished by the aer, and so we must vnderstand *Hippocrates* where he saith, That euery hot thing is nourished by that which is moderately cold.

A third.

Note this.
Athenaus.A hard place in
Galen.

Expounded;

The vses of a
Womans seede*Hippocrates*.*Argenterius* &
the Cauiller.

Answered;

Galen expounded,By a place
of *Hippocrates*.

That

That he sayth the seede is not eiaculated into the sides of the wombe because the wombe hath no hornes, sauoureth of crasse and palpable ignorance of the insertion of the eiacularory vessels into the sides of the bottome of the wombe, and so we let it passe.

Answer to the
Peripatetikes
arguments.

It remaineth now that we make answer to the arguments of the *Peripatetikes*. First therefore,

1 That double secretion or profusion of blood and seede, we do not thinke is made together and at once but at diuers times; that is, of seed in the coition and conception, of blood immediately after the first discretion or separation of the spermaticall parts.

2 There is not the same reason of young boyes and of women. For in Boyes there is no remainder of lawdable blood of which seed should bee made, because one part of the blood is consumed in their nourishment and the rest in their growth, but in women there is abundance of superfluous blood.

3 Those women who do conceiue without pleasure haue ill affected wombes.

4 *Auerrhoes* his History we take to be a right old wines tale and no credit to be giuen therero.

5 That a woman is not an imperfect male, but a perfection of mankind wee haue abundantly proued before.

6 The last argument of *Aristotle* which carrieth most shew of truth, wee may thus answer. Although a woman haue in her selfe the efficient and materiall causes of generation, yet cannot she generate in her selfe without the helpe of the man; I speake of a lawfull generation, because her seede is but weake and too cold. We see that Hennes will lay Egges without the Cocke, which we call Addle egges because they will neuer proue Chickins, neither will Cockes egges which sometimes they lay proue Chickins. Wherefore the concurrence or confluence of the seedes of both sexes is of absolute necessity in generation.

Valesius his
opinion.

Valesius answereth this Obiection thus; If a woman be of a cold constitution, her seede is too weake to endeauour of it selfe the conformation of the parts: If the woman be hotter, then is her seede fruitfull enough and of sufficient power, but then there is in such women want of the remainder of Aliment by which the seede conceiued and formed in the wombe might be nourished. Wherefore a hot woman without a man may generate, but cannot nourish and perfect that which she hath conceiued. But if these things were so as *Valesius* would haue them, then hot and mannish maydens without the embracements of men should suffer many abortments, a thing neuer heard of: But it hath bin obserued by *Hippoc.* himselfe that the geniture yssuing from a woman who hath had the company of a man, the seventh day after conception hath bin dearticulated, so that in it hath appeared the rudiments of the three principall parts and the threds of al the spermaticall parts very conspicuous: For these are the workes of seede onely and not of blood, because the blood conferreth nothing to the conformation and discretion of the parts, neither yet floweth vnto the Conception till the description of the spermaticall parts bee begun. And thus much of the seede of women wherein I haue beene somewhat more large, because the *Aduersaries* are in this point very violent and will hardly be gainsaide, whatsoever evidence of reason is brought against them. Now we proceed to the manner of the emission of seed.

Disprooued.

QUEST. VI.

Of the Excretion of the Seede, by what power or Facultie it is accomplished.

Whether the
excretion of
seed be Natural
or Animall.

Concerning the excretion or auoyding of seede, there remains two things to be handled, two doubts to be cleared. First, by what power or Faculty this excretion is made, by the Naturall or by the Animall. Secondly, why there is so great pleasure in the emission of seede. Both these doubts it shall not be hard to assoile, yet because we would giue the Reader full satisfaction, we will insist somewhat the more particularly vpon them.

That it is Natural.
Reason. I.

That the excretion of seede is altogether Natural may thus bee demonstrated. Because euery excrement is driven forth by the power of Nature, and seede is an excrement. So the menstrual blood (which is a profitable excrement of the last aliment of the fleshy parts) is purged onely by the force of Nature at certaine times and determinate courses; whereupon we call them *Courses*. So the Chylus which is the excrement of the stomack, although it be profitable, is thrust downe into the guts by the ingenite faculty of the same stomack onely. So the excretion of the excrements of the belly and of the bladder is meerely Natural. Moreover for the excretion of seed, Nature hath ordained no Muscles at all, for there appeare

appeare none in the spermatieall vessels nor in the Testicles nor in the *Prostate* Glandules.

Happly you will say there are the muscles called *Cremasteres* which compresse the Leading vessels, by which compression the seede is strayned forth; but we do not acknowledge that vse of the *Cremaster* muscles, because in the vessels of seede which are in women there are no such muscles found, who notwithstanding auoyde seede as well as men, as hath bin proued. Hereto may be added the authority of *Hippocrates*, at least of *Polybins* in his Book *de genitura*, who referreth the cause of excretion to the spumy or frothy nature of the seed, which thence being turgid and not able to containe it selfe in his place, maketh way for his owne euacuation.

Obiection.

Answer.

Hippocrates authority.

On the contrary that the excretion of seede is Animall these arguments may perswade: First, because neither whilest we wake, nor in our sleepe there is any such excretion vnlesse the force of the imagination goe before it. Secondly because in the auoyding of seede the legges and the armes are contracted and the whole body suffereth a kinde of convulsion; whereupon as wee haue already sayed, *Democritus* calleth coition a light *Epilepsie* or falling sicknes. Thirdly, because that excretion is made sometime slower sometimes sooner according to our arbitrary will and discretion. Finally, because it is alwayes ioyned with pleasure, now pleasure is an affect of the sensatiue faculty which is meerly Animall.

That it is animall Reason. I.

We are of the same opinion concerning the eiactulation of Seede that wee were of concerning the erection of the yarde, to witte, that it is a mixt action of a Naturall and an Animall: It is Animall because it hath imagination going before and pleasure alwayes accompanying it. It is Naturall, because it is made when Naure is prouoked either by an itching or tickling quality, or oppressed with a burden of abundance and that without the help of muscles.

What we conclude of. It is a mixt action.

But it must be remembred that we here speake of that profusion of seede which is Natural, not of that which is symptomaticall, which they call the *Gonorrhoea* or running of the reyns; which neither hath any imagination going before nor pleasure accompanying it, neither yet is driven out by the strength of Nature, but falleth away by reason of the waterishnes or acrimony of the seed, the weaknes of the vessels, their convulsion and the inflammation of the neighbour parts: finally, which bringeth vpon the Patient an extenuation and consumption of the whole body. Witnes that Satyre in *Thaso* whose name was *Grypalopex*, of whom *Hippocrates* maketh mention in the 7. section of the 6. book *Epidemion*, who at the age of 25. yeares poured out his seed in great abundance night and day, and in the 30. yeare was vtterly consumed and so dyed.

The causes of the running of the reines.

A History of a Satyre.

QVEST. VII.

whence commeth the pleasure in the eiactulation of Seede.

THe wonderfull prouidence of Nature hath given to all Creatures certayne goades and prouocations of lust, and an impotent desire of copulation for the preferuation of the seuerall kindes of Creatures, because the *Individuum* or particular is of it selfe and by an inbred necessity dissoluble and mortall. And indeede this sting of pleasure was very necessary, without which man (especially the one sexe) in scorne and detestation of so brutish and base a worke, the other sexe for feare of payne and trouble, would haue abhorred this worke of Nature. The Finall cause therefore of this pleasure which is conceiued in the whole action of copulation (but especially in the emission of the Seed) is onely the conseruation or preferuation of makeinde.

The finall cause of pleasure and coition.

The Efficient causes of this pleasure we acknowledge to bee many and diuerse; to omit the rest, we will make mention only of three which are the especiall and most immediate. The first is the tickling of the turgid seed: now the seed is turgid, that is, hoven or frothy by reason of the impetuous motion of the spirits; for seede without spirits (such as is auoyded in the *Gonorrhoea*) breedeth no pleasure at all; after the same manner those that abuse the vse of women by frequent copulation haue lesse pleasure then other men, because they haue fewer spirits.

3. Efficient causes.

Yet is not this cause of it selfe sufficient to procure pleasure, such especially as is conceiued, but another cause is required, which is the celerity or swiftnesse of the motion and the excretion. For as paine is neuer caused vnlesse there bee a sudden and swift alteration

2. Problems.
The first

Solution.

The second
Probleme.

The Solution.

Whether men
or women
haue greater
pleasure.

The answer.

so when the seed issueth by little and little or weepingly, there is no pleasure at all. Finally, to these two is added the exquisite sence of the parts of generation and their narrowness. For so the parts being tickled, and the vessels which were distended returning into their naturall scituation and constitution, there is stirred vp a wonderfull delight and pleasure. But that these things may be made more euident we wil handle heere two problems. The first, why the spirits as they passe through the other parts, Veins, Arteries, Sinnews, Membranes these last especially being of exquisite sence, together with the blood and the humors, do not induce the same pleasure which they doe in the spermatieall Organs. Haply it is, because this kinde of sensation by the wonderfull prouidence of Nature is bestowed onely vpon the genitals for the conseruation of the *species* or kinde, like as she hath giuen onely to the mouth of the stomach the sence of diuision and appetite. Or we may say, that in the other vessels there is not so sudden and headstrong an effusion of humors & spirits together.

The other Probleme is, why men and woemen that are asleepe haue great pleasure in their Nocturnal pollutions, seeing that in sleepe the sensatiue faculties are all at rest: for the Philosopher calleth sleep *ἐνυπνία* *ἢ ἀπὸ τῆς ἀλβαντικῆς*, *the rest of the first sensor.* We answered first, that the imagination in sleepe is stronger then when we are awake, as appeareth in those that walke and talke in their sleepe. Againe, in sleepe the senses are not so drowned in senselesnesse, but that they are rowzed vp by a violent obiect, and therefore such awake if they be violently stirred: and for the most part such nightly pollutions doe awaken those who are troubled with them. If you pricke a sleeping man with a Needle euen before he awake he gathereth vp his body; and if you continue he will awake though hee sleepe neuer so soundly. Now the excretion of seede in a dreame is indeede a very strong obiect to the spermatieall parts. These therefore are the causes of pleasure in the excretion or auoyding of seede. But whether the pleasure of the man or of the woman be the greater, it would be a vaine and fruitlesse disquisition to enquire. Indeed the woman conceiue pleasure more wales, that is in the auoyding of her owne seede and also in the attraction of the mans: for which cause *Tyresias* the Priest who had experience of both sexes preferred the woman in this kinde: but the pleasure of the man is more intense, partly because his seede is more hot and spirituous, and partly also because it yssueth with greater violence and with a kinde of *Almaine* leape or subsultation.

And thus much concerning the first principle of generation, that is, the seed of both sexes. Now we come to the second principle, which is the Mothers blood.

QUEST. VIII.

Whether the Menstruall Blood haue any noxious or hurtfull qualitie therein.

CONCERNING the Nature of the Menstruall blood, there hath beene and yet is so hard hold and so many opinions euen among Physitians them selues, that it were a shame to make mention of all their differences, much more to insist vpon them. But because we would pretermitt nothing that were worthy of your knowledge, wee will insist vpon the chiefe heads of the Controuersie. The first of which shall bee concerning the matter of the Courses.

Of the matter
of the courses.

All mendo agree that this blood is an excrement, for like a superfluity it is every month driuen forth of the wombe; but because there are two kinds of excrements, the one Naturall and profitable, the other altogether vnprofitable and vnaturall, we must enquire of which kinde this menstruall blood is.

That it is ill
qualitied.
Hippocrates au-
thority.

Aristotle.
Galen.

Moses.

The law
the

That it is an vnprofitable excrement and of a noxious or hurtfull quality, may bee pro- ued by the authority of famous learned men, as also by strong reasons. *Hippocrates* in his first Book *De morbis mulierum*, expresseth the malignant quality thereof in these wotds, *It fretteth the earth like Vineger, and gnaweth the body of the woman where soeuer it lighteth, and vlceraeth the parts of generation.* *Aristotle* in the 19. Chapter of his fourth Booke *De Natura Animalium* writeth, that that kind of blood is diseased and vitiated. *Galen* in the eight Chap. of his Book *de Atrabile* saith, that euery month a superfluous portion of blood vnprofitable not only in quantity but also in quality is auoided. *Moses* that great Law-giuer as we reade in holy Scripture, made an Edi& that no Menstruous woman should come into the Sanctuary, *Let her touch no holy thing, nor enter into the Sanctuary whilst the dayes of her purgation are fulfilled.* By the Lawes of the *Zabris*, those women that had their courses were interdicted company and society of men, and the places where she did stand were cleansed by fire.

Hesiodus

Hesiodus forbiddeth that any man should frequent those bathes where Menstruous women haue bathed themselves. *Pliny* also in the 28. Chapter of his 7. Booke and *Columella* doe thinke that this blood is not only vicious but poysonous. For by the touch thereof the young vines do wither, the buds of hearbes are burnt vp, yea glasses are infected with a kinde of *rabes*. If a Dogge lick of it he will run made, and wanton women are wont to bewitch their Louers with this blood, whence *Ouid* calleth it *Lunare virus*, the Moone poyson; wherefore it is not onely superfluous in quantity but in the whole quality a noysom excrement. This poysonous quality thereof women haue dayly and lamentable experience of in their owne bodies, for if it be suppressed it is a wonder to see what horrible and how many *symptomes* doe arise there-from.

If (sayeth *Hippocrates* in his first Booke *de morbis mulierum*) it be stabled about the womb & secret parts of the body, it ingendereth Inflammations, Cancers, S. Anthonies fires, and *scirrhus*, that is, hard & indolent tumours. If it returne vnto the vpper parts of the body, it breedeth many diseases which follow the Nature of the part affected and the offending humour. In the Liuer it breedeth the *Cachexia*, the Jaundise, the Dropsie. In the Spleene obstructions and *Scirrhus* tumors: in the Stomacke, depraued Appetite and strange longings: in the Heart palpitations and Syncopes or sounding; in the Lungs Vlcers and Consumptions: in the Brayne the falling sicknes and mad melancholly, and many other such like.

Amongst the new writers *Fernelius* the best learned Physitian of them all, in the 7. booke of his Physiologic, proueth that this blood is not Alimentarie nor of the same Nature with that by which the Infant is nourished in the mothers wombe, but thinketh it noxious and hurtfull both in the quantity and quality.

On the contrary we thinke, and perswade our selues wee shall also conuince others, to thinke that this blood which is monthly euacuated by the womb, is all one with that blood whereof the *Parenchymata* or flesh of our bowels are amassed, and wherewith the Infant in the wombe is nourished, and that it is in his owne nature laudable and pure blood and no way offensive to the woman but onely in the quantity thereof. And this we hope we shall euict both by authority of the Ancients and by inuincible and demonstratiue arguments.

First of all *Hippocrates* fauoureth this opinion as also doth *Galen*. *Hippocrates* in his first Booke *de morbis mulierum* hath this saying, *The blood falleth from a woman like the blood of a sick Sacrifice, which soone cloddeth or caketh together because it is sound and healthfull*. And this also he repeateth in his Booke *de Natura pueri*: now the conditions of laudable blood are, to be red and quickly to cake. *Galen* in his third Booke *de causis symptomatum*, writeth that this blood is not vnnaturall, but offendeth only in quantity. And this may also be demonstrated by good and true reasons: this blood in a sound woman (for if she be sickly the whole masse of blood is corrupted) the blood I say that is auoyded euery month by the wombe, is made of the same causes by and of which the other blood is made with which the flesh is satisfied and nourished. For the matter is the same, the same heat of the Liuer, the same vessels conteyning it, why then should there bee any difference in their qualities?

Moreover, if (as the Philosopher often vrgeth) the Finall cause be the most noble, and preuayleth in the workes of Nature ouer all the rest, why should this superfluous blood redound in the colde Nature of women, vnlesse that it might become an Aliment vnto the conceived and formed Infant? why doeth shee purge it rather by the wombe then by the nose, as it is often auoided in men? vnlesse it be to accustome her selfe to this way, that after the conception it may exhibit it selfe in place for the nourishment of the Infant.

This is the finall cause of the menstruous blood acknowledged by *Hippocrates*, *Aristotle*, *Galen*, and all the whole schoole of Physitians. *Aristotle* sayeth that such is the Nature of a woman, that their blood perpetually falleth to the wombe and the priue parts, and therefore if they be haile and sound of body and haue their courses in good order, they are neuer troubled with varices or swollen veines, neuer with the *Hemorrhoids* nor with bleeding at the nose as men are.

Now if these courses doe affect the way into the wombe for no other cause but onely for the nourishment of the Infant, then no man will deny but that it is benigne and laudable blood. For *Hippocrates* in his Booke *de Natura pueri* and in the first booke *de morbis mulierum* sayeth, that the Infant is nourished with pure and sweete blood; in the first place he sayth, that the Infant draweth out of the blood that which is the sweetest; in the second, that the woman with childe is pale all ouer, because her pure blood is consumed in the nourishment and increase of the Infant.

Pliny.
Columella.

Reason and
experience.

What diseases
come there
from.

Fernelius opi-
nion.

The contrary
opinion that is
is naturall.

Hippocrates.

Galen.
Reasons to
proue it natu-
rall.

First.

Second

Third.

Moreover, that the blood which Nature purgeth by the womb of a sound woman is pure and Alimentary, this is a manifest argument because it returning to the paps milke is generated, and therefore Nurfes haue not their courses as long as they giue sucke, now that milke is made of the purest blood, *Hippocrates* witnesseth in his Booke *de Natura pueri*.

Why Nurfes
haue not their
courses nei-
ther yet con-
ceiue.

Aristotle in the first Chapter of his fourth Booke *de Generatione Animalium*, sayth that the nature of the Milke and of the menstruous blood is one and the same, and thence it is that those that giue sucke haue not their courses, neither yet do conceiue with childe, and if they do happen to conceiue, then their milke faileth.

Add hereto that if the impurity of the courses were so great as some would haue it, then it would follow that when women are with childe and their courses faile vpon that cause, they should be worse disposed, then if they should faile vpon other causes, because the Infant drawing away the purer part of the blood, that other which is venomous or of a malignant quality would rage so much the more hauing lost the bridle (that is, the purer blood) whereby it is restrayned: moreover those *symptomes* would be more violent in the last moneths then in the first after conception; al which is contradicted by common experience.

Conclusion.

Wherefore the menstruall blood may abound in women, but hath no other fault at al, if they be sound and haile; and is of the same Colour, Nature and Temperament with the rest of the blood conteyned in the trunk of the hollow veine, and wherewith the flesh is nourished. Yet is it called an excrement but that *Naturæ* abusiuely; because the flesh being herewith filled and satisfied doth returne that which remayneth back into the veines and voyde it out; so the Stomacke beeing satisfied with the Chylus thrusteth it into the Guttes.

Auicenna questi-
on.

But *Auicenna* maketh a question whether this menstruall blood be an excrement of the second or of the third concoction; we say it is of both but in a diuerse respect. It is an excrement of the second concoction, because the whole masse of blood hath his first Generation in the Liuer the seate of the second concoction, and from the Liuer is powred as an ouerplus or redundancie into the trunk of the hollow veine. It is an excrement of the third concoction, because it is as we sayd vomited away by the flesh when it is satisfied after the third concoction.

Answered.

Answer to
the former ar-
guments.

Those arguments which before were alleadged against this truth are but vaine and light. For as we grant that all those mischiefes and inconueniences before named doe happen in a diseased woman, so we deny that there is any such in a sound, haile and well disposed womans body. And if at any time the suppression of the courses in a sound body doeth bring forth any of those fore-mentioned *symptomes*, that commeth to passe because of the stay and abode of it, or else because euill humors doe fall together with the blood vnto the wombe which is the common sinke as it were of the body, by the permixtion of which humours the blood acquireth a malignant quality.

The discom-
odities of the
courses proue
their purity.

Those incommodities of the menstruous blood before remembred, are great arguments of the purity thereof: for those things which are most pure are soonest vitiated, and being once taynted are most offensive; so the *symptomes* of suppressed seede are more grieuous then those that come from the suppression of the courses, because the seed is the purer and fuller of spirits.

Hence it is that the carkasse of a man casteth a worse stench or sauour then the carkasse of any other creature, because a mans body is of all other the most temperate. And *Hippocrates* in his Booke *de morbis* sayth, that by how much the Aliment is better and more pure, by so much is his corruption worse and more offensive. And thus much of the Nature and quality of the menstruous blood.

QUEST. IX.

Whether the menstruous blood be the cause of those Meazels and small Pocks which are wont once in a mans life to trouble almost euery man.

IT belongeth not to this place to dispute of the Nature, differences and all the causes of the small pocks, as also whether the *varioli*, *morbilli*, *exanthemata*, and *ethymata* be of one and the same Nature or no; wee will onely touch that which pertayneth to our present purpose.

The question.

It is a very obscure question which hath a great while exercised the wits of many men, *Whether the small Pocks and Meazels which are wont once in a mans life to happen vnto him, doe come*

come by reason of the impurity of the menstruall blood. I will not heere enlarge my selfe to reckon vp vnto you all the opinions of all men which haue written of this question, but only tell you what we thinke and that as shortly and perspicuously as the Nature of the cause will giue leaue. It is a sure thing, that among ten thousand men and women there can bee scarce one found who once in their life are not afflicted with this disease. *Auenzoar* writeth that it is almost a miracle if any man escape them.

All men haue
once the small
poxe.

It is therefore a common disease because it taketh hold of all men: Now it is *Hippocrates* resolution in his Booke *de Natura hominis*, that common diseases haue also common causes. When many men at the same time labour of the same disease, wee determine that the cause of that disease is common. But what cause may this be that is so common to all men? Not the ayre, for we doe not all breath the same ayre; one man liueth in an impure ayre, another in a pure; one inhabiteth in the North another in the South; wherefore it must bee some Principle which is this common cause. This Principle the Arabians first of all men acknowledged to be the Menstruall blood (as *Anicen*, *Auenzoar*, *Halyabas* and *Auerrhoes*) whereof the *Parenchymata* of the bowels are gathered and the particular particles of the Infant are nourished.

The opinion
of the Arabi-
ans that they
come of the
impurity of
the courses.

For though this blood be pure and laudable, yet by the permixtion of the humours which fall from all the parts of the body vnto the wombe as it were into the common poomp or sinke, it becommeth impure; whence it is that as well the spermaticall as the fleshy parts beeing defyled with that corruption, are of necessity once in a mannes lyfe cleansed and depurated, no otherwise then Wine in the caske worketh and cleanseth it selfe.

The truth of this opinion that it may appeare more cleare, we will see what may be objected to it, and discusse the same as carefully as wee can, that no scruple may bee lefte behinde.

The Infant is nourished with pure blood. *ἔλεγε* sayeth *Hippocrates* in his Booke *de Natura pueri*, *ἡ ποτὶ ἀμάλου τὸ γλυκύτατον*, It draweth out of the blood that which is the sweetest: and therefore there cannot any euill quality settle vpon the solide or fleshy parts. I answered out of the sixt Chapter of *Galen*s first Booke *de causis Symptomatum*: That the Infant whilest it is small in the first months, draweth the purest part of blood; but when it becommeth larger then it draweth the pure and impure together promiscuously: or wee say, that the blood that the Infant draweth out of the veynes wherewith it is nourished is of it owne Nature pure, but is defyled by the humours which are wont to be purged by the womb. For *Aristotle* sayeth in his tenth Booke *de Historia Animalium*, that the wombe is a seruite member, ordained to expell those things of which the body behooueth to be purged.

Reasons to the
contrary.
First.
Answered;

Againe they object, if the small poxe grow vpon the impurity of the menstruall blood, why is not that ebullition or boyling of the blood instantly in the first months when the Infant is tender and weake, (and there is the greatest disposition of the causes moouing thereunto) but after many yeares yea sometimes not before olde age? why doe not acute Agues or other diseases which happen in the life time cleanse the body of that corruption? or at least actuate it.

Second

We answered out of *Hippocrates*, that one age differeth from another and one Nature from another. A poyson will sometimes lurke in the body more yeares then one, which in the end will bewray it selfe and either oppresse Nature or bee overcome by it and auoided. So the virulency and poyson of the French disease & of the leprosy wil lie hid for some yeares, and the poyson of a mad dog a great while before it shew it selfe.

Answered.

Their third reason is, That some men are troubled with the smal pox oftner then once yea many times, and therefore they proceed other-whence then from the infection of the menstruall blood. But this is a childish argument; for the disease doth therefore retorne because haply the expulsiue faculty is weak and thereupon there remaine some reliques of the matter of the disease: so sayth *Hippocrates* in the 12. Aphorisme of the 2. Section, *Reliquia morborum Recidiuos faciunt morbos*. The remainders or reliques of diseases are wont to be the causes of relapses.

Third.

Answered;

Their fourth reason is, the menstruall blood is turned into the substance of the parts by nutrition; now the parts do not suffer any ebullition but the humors onely, it is therefore absurd to imagine that the pox should be generated of their heat or ebullition; to whom we answered thus. The solide parts do not indeed worke or suffer ebullition, but they doe infect the humors with that quality which they acquire from the impuritie of those peccant humors which accompany the menstruall blood, which humors boiling and being offensive to nature, are thrust out into the skin; inso much as the parts themselves are purged by that working which is in the blood.

Fourth;

Answered;

So musty vessels (saith *Auenzoar*) do infect the wine contained in them, but if the wine do worke in a musty vessell, then it becommeth sweete ever after.

Fift.

Answered.

The fift reason is, if the poxe do arise out of the impurity of the Menstruall blood, why then are not women ouer-taken with the pox when their courses are stopped? We answer, that the blood so suppressed is only in the veins, and is not sprinkled through the substance of the parts, and therefore doth not settle that malignant quality in the solid parts.

Sixt.

Answered.

Their sixth reason. Why are not brute beasts which are full of blood and haue the matter of those monthly euacuations the matter you say of the poxe, and a working heate beside? why haue not such beasts the pox also? Haply, because they vse a drier kind of nourishment and beside lead their whole life in labor and exercise, whence it is that the reliques of their impure blood are spent and euaporated. But a man in his tender infancy sucketh abundantly, and after he is wayned neuer ceaseth eating, and beside, the first seauen yeares of his age he spenderh in great idlenesse.

Seuenth.

Answered.

Finally, seeing the fault of the Mothers blood hath continued ever since the beginning of the world, so that this disease should haue been the most ancient of all others, how com-meth it to passe that neither *Hippocrates* nor *Galen*, nor any of the *Gracians* did euer make any mention thereof; insomuch that it seemeth to be a new disease known only to the *Moore*s? It is not likely therefore that it proceedeth from the impurity of the Mothers blood.

But we say that it is very likely that the disease was of old time, but because men were more continent and liued in better order then now they do, it was not so ordinary in the former times as now it is. *Hippocrates* in his Books *Epidemion* doth often make mention of red, round, and small Pustules which he calleth *Exanthemata*; & *Atius* in his 14. book saith, that children had certaine Pustules or wheelkes which brake out all ouer their bodies. I do not therefore thinke that this disease was altogether vnkowne to the *Grecians*, but haply not so accurately described, because in those dayes by reason of their good dyet, the symptoms or accidents of the disease were not so dangerous. So euen at this day we haue knowne many full of the poxe without either Ague or vomiting, or any notable disease at all; and children oftentimes haue them and know not of it till they be gone.

Fernelius his opinion con-tuted.

They which referre the cause of the poxe to the malignant disposition of the aer, are in my opinion far wide, for then we must needs acknowledge that the aer is alwaies infected, because we see Children haue them at all times and seasons and euery yeare. Neyther then would the disease haunt Children onely, but old folke also as the plague dooth; neither would it happen onely once in a mans life, but as often as the aer is so affected, as it dooth in the plague and other Epidemiall and pestilent diseases which come from the aer.

Mercurialis his opinion.

Mercurialis that learned man in an elegant Booke hee set out concerning the diseases of children resolueth many and those very obscure problemes of the nature and causes of these small pox, but endeauouring to establish a new and vheard of cause of them, hee seemeth to be mistaken.

His opinion is, that the poxe is a new disease vnkowne altogether to the *Grecians*, and that it sprang first of all from the ill disposition of the heauens and the aer, and raged almost vpon all men; who afterward being themselves tainted, conferred the succession of the disease vpon their posterities. For as a gowty Father begetteth a gowty child, and a leprous father a leprous childe, an Epilepticall father an Epilepticall childe, why also should not a father infected with this poisonous disease communicate the same disposition to his child? These things may seeme to some very probable, but if we looke more narrowly into them, they will scarce hold water, as we say.

The first Reason.

For to knit vp all in few words, Hereditary diseases are not communicated from the Father or Mother to the childe, but by seedes. These seeds containe in them potentially the Idea, Formes and Proprieties of all the partes. So the seede of an arthriticall or calculous Father hath in it the disposition of the gowt or the stone; wherefore that disposition of the pox must remaine in the solid parts of the parent. But in those who haue had the poxe and are perfectly recouered of them, there remaineth no corruption nor any such disposition as being wholly euacuated by critical excretion and eruption of the pustles; otherwise out of doubt the disease would againe returne. How therefore shall they communicate vnto their children that poysonous disposition which now they themselves haue not in their solid parts? Neither are all diseases hereditary, but those onely which are *in being* in a mans body, and therefore putrid Agues and such other diseases as happen by accident, are not communicated to the children. Now at that time when this disease first began to rage, it must

What diseases are hereditary.

must needs be granted that it was as we say in Schooles *Morbis Fiens*, that is, a disease not subsisting but breeding, hauing his hearth or seate in the corruption of the humours, and therefore it could not be communicated to the children. Add hereto, that if these things were so, it would follow, that as we are all once in our liues troubled with the pox, so we should once in our liues be troubled with the plague. For the time hath beene when the plague raged so fierce that few men escaped it. As is the poxe so is the plague a common disease contracted from the fault and impurity of the aer, why then should not our parents leaue vs also that vnwelcome inheritance as well as they do the poxe?

We conclude therefore with the *Arabians*, that the cause of the poxe is the impurity of the Mothers blood wherewith the infant is nourished; which impurity it acquireth as well by his stay in the body beyond the limited time, as also from the permixtion of the humors which fall into the womb as vnto the sinke of the body.

QUEST. X.

Of the causes of the periodicall euacuation of the Menstrua.

ALl men know that the Menstruall blood is purged through the wombe by certaine standing and limited circuites and Courses, but the causes of this returne is a very hard thing to find out. Many do wonder why seeing all other excrements are euacuated euery day, this blood which is the excrement of the last Aliment should be auoided but once in a month.

The thicke excrements of the first concoction as they are daily generated, so they are daily auoided. The Choller is euery day thrust out of the Liuer into the bladder of the gal, and thence into the *Duodenum*; the vrine is daily transcolated from the Kidneyes vnto the bladder of vrine. So likewise the excrements of the third concoction, those of the habit of the body are spent by sweating, breathing and insensible transpiration, by the haire and the foile of the skin. Those of the braine by the palate, by the nosethrills, the eares and the eyes; those of the chest by coughing; why therefore is not the Menstruall blood euery day euacuated, seeing it hath a continuall generation?

This I thinke is to be attributed onely to the singular providence of Nature, and to the Finall cause the most excellent of all the rest. For if the blood were euery day purged away by the wombe, then could women neuer conceiue with childe, neyther yet any man haue due and comfortable vse of a woman. First conception would be hindred, because the seed powred out into the cavity of the wombe, would either fall backe or be extinguished; the coates of the wombe being irrigated, moistned and as it were inebriated or made drunke by the daily affluence of the blood. So saith *Hippocrates* in the 62. Aphorisme of the first section, *Those women that haue moist wombs do not conceiue, because their geniture is extinguished.* Beside, what pleasure or contentment could any man finde in a wife so lothsomly defiled, and that perpetually? It was not therefore fit for the accomplishment of the intention of Nature, that a womans blood should issue euery day, but only at certaine and definite times and circuites, to wit, once euery month.

But why this excretion should be made euery month not oftner nor more seldome, is a great question and I assure you very full of difficulty. *Aristotle* in the 2. and 4. *de generatione Animalium*, referreth the reason of this periodicall or certaine euacuation to the motion of the Moone, and saith; that when the Moone is in the wane womens courses do especially flow, because at that time the aer is colder and moister, from whence comes the encrease and abundance of that colde and crude humour; but *Aristotle* is by some heerein reprehended, because in the full of the Moone all things are most moiste, as appeareth by Shellfishes, Oysters, and such like. The *Peripatetickes* answer, that there is a double humiditie, one viuificall or liuely, the other excrementitious. The first is encreased in the full of the Moone, because then there is more light; the second is encreased in the wane, because then the aer is colder; now Menstruall blood is generated by a weake heate.

The *Arabians* thinke there are diuers times of this purgation, according to the diuersitie of womens ages. Young women (say they) are purged in the new Moone, and elder women in the old moone, whence cometh that common verse.

Luna vetus vetulas, iuuenes noua Luna repurgat.

Young women in the New Moone purge, Old women in the wane.

Some there are, who referre the cause of this circuite and monthly euacuation to the propriety of the month, as if the month had a peculiar power to purge the courses, as the day hath to purge the ordinary excrements. And for this wee may alleage a notable testimo-

The second

The conclu-
sion with the
Arabians.Why it is not
purged euery
day.The true rea-
son.Why it is pur-
ged euery
month.
Aristotles opi-
nion.The *Arabians*
opinion.A strange place
in *Hippocrates*.

ny of Hippocrates in his Booke *de septimestri partu*, where he sayeth, *In the moneths the same things are done by certaine and right reason which are done in dayes: for every moneth hayle women haue their courses as if the month had a peculiar power and efficacy in their bodies.* We must needs acknowledge that the Moone hath great power ouer inferior bodies, but that the sole cause of the Criticall daies and of this menstruall euacuation should be referred to the motion of the Moone I could neuer yet perswade my selfe.

What we resolve vpon.

How Nature is prouoked.

How hindred.

That many things are dispensed by numbers and by months I doe not deny; but to attribute any operative power to discrete quantity and to number as it is number, I thinke is vnworthy of a Philosopher. It is more wisdom to referre the cause of this periodical euacuation to the determinate motions and established lawes of Nature to vs vnkowne, which yet she neuer breaketh or abrogateth, but keepes immutable and inuolable vnlesse she bee either prouoked or hindred: for when she is prouoked she antiuerteth or hastineth the excretion auoyding the blood before her owne time. So whereas the seuenth dayes are onely truely criticall, yet Nature indeuoureth vacuations sometimes in the dayes betweene, yea and accomplisheth them, because of some prouocation comming from without, that is beside her owne lawfull contention. Againe, being hindered either by the narrowness of the passages, or by thicknes of the humours, she oftentimes procrastineth and delayeth their accustomed euacuation.

Hence it is that in some women the courses flow twice in a month, in some scarce before every fortieth day. But why the blood should flow from the wombe rather once every month then twice, or why the seauenth dayes should rather be criticall then the sixth *ἡμέρα*, *πρὶν ὅτι περὶ βαρυον οὐκ εἶναι, is above the capacity of humane wit.*

Hippocrates promise.

Not kept.

All secrets of nature not to be knowne.

Hippocrates verily promiserh in the end of his Booke *de principijs*, to make manifest the necessity of Nature why she dispenseth all things in the seauenth dayes: but I thinke he was dissuaded by the difficulty of the buisinesse, and therefore no where perfourmeth that promise. Wherefore seeing he that best could durst not aduenture vpon it, we will also ingenuously confesse our ignorance and ranke these secrets among those mysteries of Nature which she reserueth onely to her selfe to teach vs not onely in this but in other things, to obserue her administrations the better and to suspect our owne weaknes. For wee see that in the most abiect and base things of the world there are some secrets of Nature whereof either we are not at all capable or not yet sufficiently instructed in them.

And thus much concerning that other principle of Generation, the mothers blood, now it followeth that we come vnto the Conception, wherein also we shall finde some difficulties worthy the discussing.

QUEST. XI.

whether it be necessary to Conception that the Seed of both Sexes should issue together, and that with pleasure, and be presently mingled.

Auerroes opinion of the euacuation.

How finely he was gulled by a light skirts.

Auerroes Disproued.

1. Reason.

2. Reason.

WE haue already proued that both the Seeds as well the fathers as the mothers are required in a perfect Generation; but whether they ought both at once to be euacuated is not yet so eident. *Auerroes* contendeth that the euacuation of the seed into the cavity of the womb is not alwayes necessary, & that a woman may Conceive without the embracements of a man. And to this purpose he telleth a Tale of a woman who conceived the seed of a man floating in the water of a bath, so strong sayeth hee was the attractive faculty of the womb in drawing of seed. But it is great wonder that a Philosopher would be so credulous to beleue the excuse of a light-skirts, who to saue her honesty deuised this excuse by looking vpon her apron strings; for sayth he a neighbour of mine told me this tale of her selfe. The woman I cannot but commend for her wit, though not for her honesty: but *Auerroes* had forgot what his maister *Aristotle* taught him in his second Booke *de Generatione Animalium*. Seed sayeth he is altogether aerie, frothy, and if it be exposed to the ayre it presently melteth, groweth waterish and becommeth vnfruitfull. In the sixth Chapter also of his first Booke *de Generatione Animalium*, he writeth that those creatures which haue long yards or virile members are therefore vnfruitfull, because in the length of the way the seed is refrigerated. If therefore it may be refrigerated in his first and naturall concepracle, much more being exposed to the ayre or lost in the water.

Those which are called *ὑποσπασιαῖοι* whose common passage of seede and vrine is turned aside, by reason that the yarde is too hard reined with the bridle, cannot generate; not because they haue not fruitfull seede, but because hanging a little in the contortion of the yard,

yard, it cannot immediately be conueyed into the wombe whilst it reteineth his heat and spirits, as saith *Galen* in the 3. chapter of his 15. Booke *de usu partium*.

Doth not *Hippocrates* in his first Booke *de Morbis mulierum* affirme that to be a cause of sterility and barrenesse in women when the womb is peruerterd or distorted, because then the seed cannot directly passe without delay vnto the inner orifice of the same? It is therefore necessary *O Auerrhoes* that there be a direct and impetuous or forcible eiaculation of the seed of the man into the wombe of the woman. Furthermore, because in brute beasts which couerone the other, the eiaculation of the seed into the wombe is more direct, it cometh to passe that at once couering for the most part they holde as we vse to say, which is not so betwixt reasonable creatures. Againe, beastes are quiet in that action, being so taught by Nature, for motion often preuenteth conception.

Now, if at the same time both sexes yeelde their seed, then is the conception sooner, and also more perfect, because the wombe at that time being as it were enraged, doeth more greedily draw and more narrowly embrace the seede which is cast vnto it. This *Hippocrates* acknowledgeth in his first Booke *de morbis Mulierum* in these words; *If that which proceedeth from the man, doth together and in a right line concurre and meete with that which is auoyded by the woman, then doth the woman sooner conceiue*, he saith *ἡ δὲ γυνὴ*. by a Metaphor taken from Water-men, who together do arise vpon their Rowers, together dip them in the water, and together driue their stroke. And whereas he saith that they sooner conceiue, it is an argument that it is not of absolute necessity vnto generation, that both sexes should at one and the same time yeeld their seeds; but that there may be conception though it bee slower, if one come a little before or after another; but if the distance of time bee too great between them then the conception succeedeth not, because the spirits of the first seede are exhausted and dissipated before the second ariue vnto it.

The same thing hath *Aristotle* in his tenth Booke *De Historia Animalium*, vpon which *Scaliger* hath written an excellent Commentary, as that mirror of Learning did all things excellently: There are (saith he) that thinke, there can be no conception vnlesse the seeds of both sexes do at the same time meete one with another; these are deceiued, because the better habited body sooner yeeldeth, wherefore that seed being the stronger, is not corrupted but reteineth his spirits, and being drawne by the wombe, is retained for the future permixtion, so that to conception simply this concurrence of seeds at one and the same time is not absolutely, but to a sooner conception it is necessary.

It is also demanded, whether conception may bee without pleasure. On the mans part there is no question, but on the womans; for you shall heare many say that they haue no sense or inkling of pleasure at all. *Dianus* is of this minde that conception is not alwaies with pleasure on the womans part; but *Diana* were a better iudge of this controuersy: let vs heare his reason, because sometimes (saith he) the seede is immediately eiaculated into the bottom of the womb which is of a duller sense, neuer touching the orifice whose sense is more exquisite. A pretty shift I promise yon, but the good man was in an error. For pleasure is not therefore conceiued because the seede toucheth the orifice of the wombe, but because it runneth through the spermatieall vessels of the woman which are of exquisite sense, otherwise women with childe who eiaculate their seed not into the inward orifice, but into the middle of the necke of the wombe, should haue no pleasure in such eiaculations; but it is manifest that they haue greater pleasure after they bee with child then before, because their seed passeth a longer course, as we shall say more at large in our Discourse of Superfoetation.

Hippocrates in his Booke *de Principijs* assoileth this question. For after hee hath giuen vs some signes of conception he saith, that these do not happen to all women, but vnto those onely whose bodyes are pure and cleane; but where the body is grosse, full of mucous and impure humors, there are no such signes. That is to say, an impure, mucous and moyste woman may conceiue without pleasure, or any sence of titillation at all.

Finally, some doubt whether the permixtion of the seeds bee requisite to conception, because it is absurd to thinke that species or kinds are mixed: againe, if they be mixed then should essences be intended and remitted, which in Philosophy is a grosse absurdity, because euery essence is impartible. Likewise of two beings by themselves, one being by it selfe cannot be made. But we answer, that the Seeds being not actually animated, they doe not of themselves make the species of the Creature. If it bee granted also according

o *Aristotle*, that they are imperfect essences or beings, it is necessary that they should bee mixed,

The reason.

Why Beasts
conceiue at
the first.

It is not ne-
cessary that
the eiaculati-
on of both
seeds should
be at once,

Proued by *A-
ristotles* autho-
rity.

Whether con-
ception may
be without
pleasure.
Dianus opinion

Confuted.

The question
assoyled by
Hippocrates.

Whether the
seeds of both
sexes be min-
gled.

Obiections.

Answered.

Aristotle.

Hippocrates.

mixed, otherwise they cannot bee nourished or animated together, as Hippocrates sayeth in his Booke *de Natura pueri*. And in his first Booke *de diata*, he blameth them that doubt whether of two fires a third may arise. If any man saith he, deny that a Soule is mingled with a Soule, that is, one seed with another, let him be held for an Idiot in Physicke. And in the very beginning of his book *de Natura pueri*. If the geniture proceeding from both the parents be retained in the wombe of the woman, they are presently mixed into one. And thus much of the effusion of the seeds of both Sexes, the pleasure thereupon conceived, and the permixtion of the seeds themselves.

QUEST. XII.

Whether the wombe haue any operative or active power in the conformation of the Creature.

A double agent.

I will not be hard to untie this knot. According to the Philosophers rule there is a double agent, one Principall another Helpfull or assistant only. A principal agent no man will say the wombe is, because then a woman could conceiue alone without the helpe of the man, and besides Females onely, Males neuer should be formed. The wombe therefore worketh as *Causa sine qua non*, a cause not so much of the being, as without which it could not be; because it awaketh and stirreth vp the sleepey and hidden vertue of the seede. The Physitians make three kindes of Efficient causes. Principall, Helping, or that without which a thing cannot be done.

3. kinds of Efficient causes among Physitians.

How many wayes the wombe worketh. First by traction.

So in Purgations the principall cause is the propriety of the medicine, the Helping cause is the hot Temper; the cause *sine qua non* is our naturall heate, without which the power of the medicine being drowfie would neuer be brought into act. So in the conformation of the Infant, the principall cause is the Seed, I meane the spirits of the seed, by which as by workemen the Soule which is the noble and chiefe Architect frameth a mansion fit for the performance of her different functions. The Helping cause is a laudable Temper of the seeds and of the wombe. The *Causa sine qua non* is the wombe. For because the seeds are not actually Animated but onely potentially, they need another principle whereby their power may be brought into act: the wombe therefore worketh diuerse wayes. First of all it draweth the Seede of the man through the necke, no otherwise then a Hart draweth a Snake by his nosethrilles out of the earth. For the seed is not powred into the cavity of the wombe as some of the Auncients thought, but into the necke thereof. The bottome therefore of the wombe meeteth with the Seede halfe way, and with his inward mouth as with a hand it snatcheth it vnto it selfe and layeth it vp safely in her bosome. And euen as, sayeth Galen in his first Booke *de semine*, a hungry stomacke runneth with his bottome euen vnto the throate to snatch the meate out of the mouth before it be halfe chewed; so the wombe which is the very seat of Concupiscence, being desirous and longing after the seed, moueth it selfe wholly euen to the priuities, and this is the first action of the wombe, to wit, the traction of the seed of the man.

2. By mixtion.

The second action of the wombe is the permixtion of the seeds; now they be mixed either by themselves or by another; not of themselves because they are not alwayes auoided at the same time, as we haue in the question before going proued out of Hippocrates and Aristotle; neither yet are they eiaculated into the same place, for the mans seede is cast into the neck of the womb, the womans into the sides of the bottome which we call the horns of the wombe: the wombe therefore maketh this permixtion of the seeds which the Barbarians call *Aggregation*.

3. By retention.

The third action of the wombe is the Retention of the seeds, in which the woman feeleth a manifest motion of the wombe: for it gathereth, crumpleth and corrugateth it selfe, and so exquisitely shutteth his orifice that it will not admit the poynt of a Probe.

4. By conception.

The last action of the wombe is the suscitation or raising vp of the facultie of the seedes which wee commonly call Conception. Now the faculty of the seed is rayfed or rowfed, not so much by the heate of the wombe as by his in-bred propriety, for if the seede should be cast into any other part of the body though it were hotter then the wombe, it would not be conceyued but putrified.

After Conception the action of the wombe ceaseth; the whole proceffe of the worke of Nature, in forming, nourishing and increasing is left vnto the Infant: this one thing the wombe performeth, it conteyneth, preserueth and cheriseth the Infant, because the place is the preseruer of that which is placed therein.

QUEST.

QUEST. XIII.

Of vitious or faulty Conceptions, and especially of the Mola.

THat Conception is made by the in-bred propriety of the Wombe, this among the rest manifestly prooueth, that into what part of the body soeuer, sauing into this, the seede is powred, this power or efficacy is neuer stirred vp, neither commeth into act; so that conception is as properly the action of the wombe, as Chylification is the action of the stomacke. But that conception may be perfect, the seede which is yeelded and retained must be pure and fruitfull. By pure I vnderstand with Hippocrates, that which is not sickly or diseased, neither yet mingled with blood. For blood is not requisite to generation til after the description of the spermatical parts is begun; otherwise the seed being choaked by the abundance of the blood, neither at all attempteth his worke, neither can it bring to perfection that it could haue well begun. Againe, if the seeds be vnfruitfull, what hope can there be of a harvest?

To perfect conception there is further required an *εὐκρασία* or lawdable temper of the wombe; for those whose wombes are either hot or colde, or moyst or dry above measure do not conceiue as saith Hippocrates. If therefore any of these things be wanting, wee cannot hope for a lawfull conception, but either there will bee none at all, or a depraued and vitious, such as is of the Moone-calse or Mola. For Nature rather endeauoureth an imperfect and depraued Conception then none at all, because she is greedy of propagation and diligent to maintaine the perpetuity of the kindes of things: wherefore rather then she will do nothing, she will endeavour any thing how imperfect soeuer. So when Nature maketh wormes in the stomacke and guts, she doth better then if she should generate nothing at all, because of a thing immoueable she maketh a thing moouable by it selfe, and of it selfe, and of a putrid and rotten humour an animated creature.

The nature and causes of this faulty conception which they call the Mola or Moon-calse we will endeauour to finde out. The Mola the Grecians call *μολή* or *μολισμός*, some thinke that the name came from a Bakers Mill, because it is like thereto both in hardnesse and in roundnesse. Among the Persians the word *Moli* signifieth a deformed thing. *Affranus* the Poet calleth it *Molucrum*, *Aristotle* often *Μόλυσμα*, because it is like a parboyled thing. Wee call it *A Moone-calse*. *Galen* in the 7. Chapter of his 14. Booke *de vsu partium*, defineth a Mola to be *σάρκα ἀργήν καὶ ἀδιάπλαστον*, that is, an Idle and imperfect flesh. But this definition dooth not expresse the whole Nature of the Mola. For there may bee a rude flesh generated without motion, which is not a Mola. There are euery where Caruncles generated, which no man will call Moles. We think that this rather is a perfect definition of a Mola. *The Mola or moone calse is an idle flesh without forme and hard, engendred onely in the wombe of a woman, and that of weake seede, which seede vnder taking the Conformation, but beeing oppressed or stifled with abundance of blood, it cannot attaine his owne end, and therefore in steade of a creature generateth a lumpe of flesh.*

The particular parts of this definition we will discourse of and discusse in order. The Mola is a flesh, because his substance is fleshy and red like clodded blood. It is Idle, that is, without any Animall motion; for it is not at all moued vnlesse it be after the motion of the wombe. It is rude without forme, not that it wanteth his owne forme, for it hath as saith the Philosopher his owne being, but it hath neyther *εἶδος* nor *μορφήν* that is, neither the species nor the former of a creature. It is engendred onely in the wombe of a woman, because as writeth *Aristotle*, onely a woman hath abundance of menstruall purgations, for that her diet is moist, and her course of life sluggish and idle in respect of other creatures. That which is objected of the Beare which alwaies bringeth foorth her young rude and vnformed, and perfecteth them by licking, either we say it is a Fable, or else that their young doe appeare deformed or vnformed but are not so indeed, but because they lurke all winter in the caues of the earth, they are couered with a slimy & Flegmaticke moysture which the Dam licking off makes their proportion appeare.

The rest of the parts of our definition, doe fully declare the manner of the generation, and the causes of the Mola. I know there are diuers opinions of the Ancients concerning their generation. *Plutark* saith, that a Mola may be generated without the cōpany of a man, whom many follow, who thinke it may be generated only of the seed of the woman, when

What is required to perfect conception.

Nature endeuoureth a depraued conception rather then none and why.

The names of the mola.

Affranus.

Galen's definition.

A perfect definition of the mola.

Flesh. Idle.

Rude.

Only in a Woman.

Plutark of the mola. Disproued.

to

to it a great quantity of her blood accrueth. But this opinion is disprooued by *Galen* in the 7. Chapter of his 14. Booke *de usu partium*, where hee saith that among all creatures which walke continually vpon the earth, none doe euer conceiue without the seede of the Male, no not a faulty or vitious conception; because all beginning of conformation proceedeth from the seed of the Male as that which is the first principle of Generation. Addhereto that if a *Mole* could be conceiued only of the seed of the woman, then those Virgines which doe suffer nightly pollutions might conceiue the same, which neuer yet was heard of.

Mercurialis,
his opinion.

Refuted.

Hippocrates
opinion.

The Coagmentation therefore of the *Mole* is neuer made without copulation. Some thinke that the *Mole* is generated as other flesh, onely by the affluence of abundance of blood which is gathered or caked together by the heate of the wombe. But because the blood hath no aſtiue or operative power but onely paſſiue, I doe not see how a *Moale* can be made onely of blood; when as we see it is tyed with ligaments to the wombe and inuested with membranes, which ligaments and membranes are the rudiments of a conformation inchoated or begunne. Neither are wee to giue credite to them that affirme that it is generated onely of crude and corrupted seede, or when the seede of the woman ouercometh the Seed of the Male. The true manner of their Generation *Hippocrates* setteth down in his first Booke *de morbis mulierum*, which, because we esteeme it as an Oracle, I will here transcribe. *Concerning the Conception of the Mole this is the very truth: when a great abundance of blood cloyeth a little ill disposed seed, there cannot bee a lawfull conception, yet the belly swelleth as if the woman were with Child.* What could be sayed more succinctly, what to better purpose?

Explained.

Two things he requireth to the Generation of the *Mola*: First that there be the Seede of the man; but that in little quantity and vitious or faulty. Secondly that great quantity of blood should flow vnto it. That little and vitiated seede vndertaketh the worke of conformation and beginneth to forme the membranes; for almost all Moone. calues are couered with filmes and membranes.

The manner of
the generation
of the mole.

But when as the seede thus little and weake endeuoureth to perfect his woorke hee hath begun, then is the discretion or separation of the parts hindered and interrupted by the affluence of too much blood, & the Conception becommeth illegitimate, because the blood beareth greater sway then the seede; so that in steade of a living Creature which was the first intention of Nature, there is generated an vnformed and rude masse of flesh hauing indeede the principles of Life, but those so weake that they are presently suffocated and extinguished. For whereas it dayly groweth and encreaseth, that commeth not by true nutrition but by apposition onely. Some thinke that this flesh is not altogether without life, but iust as if they should say it had halfe a Soule.

Aetnarius definition.

It is therefore *Hippocrates* resolution that the *mola* can neuer bee generated without the seede of the man, and that the beginning of the coagmentation or gathering of the same is alwayes from that same seed. The very same thing *Aetnarius* confirmeth by this definition. *The Mola* sayeth he, *is a fleshy tumor which hath his beginning and his firmnesse or fastnesse from prolificall Seede.* And thus much shall haue bene sufficient to haue sayd of the Nature and cause of the *Mola*.

The signes to
distinguish a
mole from an
Infant out of
Hippocrates.

The tumor of
the belly.

The motion.

Now let vs acquaint you by what notes and signes it may be distinguished from a true Conception. *Hippocrates* in his first Booke *de morbis mulierum*, and in his Book *de Sterilibus*, conceiue that the signes of the *Mola* are fetcht from these foure. The tumor or swelling of the belly, the motion, milk & the time of the gestation. For the first, the belly sooner swells vpon the conception of a *Mola* then of an Infant; beside, it is stiffer stretched and carried with more difficulty. For the motion; if after the third and fourth moneth the woman feele no motion the Conception is faulty; for sayeth *Hippocrates*, Male Infants do moue the third moneth and Females the fourth.

But the *Mola* is altogether immouable vnlesse it be accidentally moued together with the wombe: and if a woman in that case feele sometimes a trembling and panting motion, wee say it is not so much caused by the *Mola* it selfe, as from the wombe which strueth to shake off so vnprofitable a burthen. Beside, the motion of the *Mola* and the Infant is altogether vnlike: for the Infant of it owne accord turneth himselfe and mooueth euery way, the *Mola* like a bowle or vnwealdy bulke is rowled to the right side or to the lefte as the womb doeth incline to either hand. A *Mola* pressed with the hand giueth way instantly, but presently returneth thither againe: the Infant as it yeeldeth not presently, so after it hath giuen way it returneth not into the same place and position againe.

The

The third signe of the Mole Hippocrates taketh from the nature of the Milke. *This is the greatest and most certaine argument of the Mola, if there appeare no Milke in the Pappes.* But if the Conceptions be legitimate, there is Milke. For this we haue a golden saying in the Booke *De Natura Pueri*, *As soone as the Infant beginneth to moue, even then the Milke bewrayeth it to the Mother.* But if a Mola be conceived, there is no Milke generated. Amongst all the rest, there is indeed no signe so infallible as that which is fetched from the time of the Gestation. For, if the Tumor of the Belly continue after the eleuenth month, which is the utmost limit of gestation, and yet there appeare no signes of a Dropsie, we may be bold to say, It is not an Infant but a Mola that is conceived. And Hippocrates saith, *That a Woman may beare a Mola two yea three yeeres.*

Three signes from the milke

Hippocrates

Aristotle also in the seventh Chapter of his fourth Booke *De Generatione Animalium* saith, that a Mola may endure in a Womans Body foure yeeres, yea the whole course of her life, so that she may grow old with it, yea and dye with it of another disease. And in the tenth Booke *De Historia Animalium* he rendreth the reason, *Because (saith he) being no Creature it vttereth not the wombe neither moueth therein as doth the Child, who by kicking seeketh a way out for himselfe.* Moreover, the Mola breatheth not, neither needeth any aire at all, and therefore seeketh not passage for it.

A Mola may lye long in the wombe and why.

The late Writers add, that the Woman which hath conceived a Mola becommeth pale, looseth all her colour, yea and pineth away in her whole Body. And thus much of the Mola his nature, and the signes whereby it may be distinguished from a lawfull Conception.

QUEST. XIII.

Of Monsters and Hermaphrodites.

O depraued and illegitimate Conceptions must Monsters be referred, concerning which, it shall not be out of our way to giue you some brieue notice. Monsters Aristotle calleth Excursions and Digressions of Nature, taking his Metaphor from Trauellers, who wander out of their way yet goe still on their intended iourney. For when Nature cannot accomplish and bring to perfection that she intendeth, least she should be idle, which is a thing incompetent to her disposition, she doth what she can. And in the second Booke of his *Physickes*, he defineth a Monster to be a fault, or error, or preuarication of Nature working for some end of which she is frustrated because of some principle corrupted.

The definition of a Monster.

Monsters happen many wayes, and there are of them innumerable differences. We will onely handle the chiefe in this place, because haply in another worke we may be in this kind more particular. Monsters happen either when the Sex is vitiated, or when the Conformation is vnlawfull. In the Sex, when they are of an vncertaine Sex, so that you may doubt whether it be a Male, or a Female, or both, as Hermaphrodites. By-sexed Hermaphrodites they call *Androgynas*, *ἀνδρῶν καὶ θηνῶν*, *ἀνδροθῆνας*. In Males that commeth to passe three manner of wayes. When in the *Perinaum* or *Interfaminium*, that is, the place between the Cod and the Fundament, there appeareth a small Womans Priuitie: againe, when the same hapneth in the Cod but without any auoyding of Excrement by it: and thirdly, when in the same place the Vrine issueth. In Females there is but one manner, when a Yard or Virile member beareth out in the bottome of the Share-bone about the top of the Genitall in the place of the *Clitoris*. Some add in Men, when there appeareth a small Priuitie of a Woman about the root of the Yard. In Women, when a Yard appeareth at the Leske, or in the *Perinaum*.

The differences.

Monsters in Sex.

How many kinds of Hermaphrodites

In Conformation Monsters are more ordinarie. To Conformation we referre Figure, Magnitude, Scituation and Number. In Figure Monsters happen: if a Man haue a prone or declining Figure like a brute Beast, if he haue the Face of a Dogge, of a Wolfe, a Fox, a Toad, or such like. In Magnitude exceeding or deficient: if there be an vnequall proportion of the parts, as a great Head, or againe, so little that it agreeth not with the rest of the parts. In Scituation, as if the Eyes be in the middle of the Forehead, the Nofethrils in the sides, the Eares in the Nowle, or such like. In Number exceeding, as when it is diuided into two Bodyes, two Heads, foure Armes, or such like: or deficient, if it haue but one Eye, no Eares, and the like.

Monsters in conformation

In figure

Magnitude

Scituation

Number

The causes of
Monsters.

The true
causes.

Monsters
from the
matter.

Why so many
Monsters in
Egypt and
Africa.

The difference
of Monsters
from the
Efficient.

A History.

Concerning the causes of Monsters, diuers Men are of diuers minds. The Diuine refers it to the iudgement of God: the Astrologers to the Starres: *Alcabitius* saith, there are certaine degrees in which if the Moone be when a Child is conceived, the birth becommeth monstrous. We list not to exclude the iust vengeance of Almighty God, which no doubt hath a great stroake in these things: but to speake as a Physitian or naturall Philosopher, it must be granted that all these Aberrations of Nature are to be referred vnto the Materiall and Efficient causes of Generation. The Matter is the Seed, the Efficient or Agent is either Primarie or Secundarie. The Primarie or principle cause is double. The formative Faculty and the Imagination. The Secundarie is the Instrument, to wit, the place and certaine qualities as heat. The Matter is in fault three wayes. For it is either Deficient or Abundant, or is diuersly mixed. If there be want of Spermatick matter, then the Monster is deficient either in Magnitude or in Number. If there be ouer-plus of Seed, they become double headed, with foure Armes, &c. If there be a confused permixtion of the Seed, then are Monsters generated of diuers kinds: as vpon Sodomie and vnaturall copulations of Men and Beasts horrible Monsters haue been brought into the World: so *Aristotle* saith, that in *Egypt* and *Africa* where Beasts of diuers kinds meet at the Waters of *Nilus*, or in the Desert-places and mis-match themselves, there are often many Monsters generated. And thus come Monsters arising from the Matter. From the Agent or Efficient Monsters may happen diuers wayes. The Primarie Agent as we said, was either the formative Facultie or the Imagination. The power of the Imagination we shall shew a little after in a fitter place, here it shall be sufficient to shew out of the learning of the *Arabians*, that a strong Imagination is able to produce Formes even as (say they) the superiour Intelligences in the Heauens doe produce the formes of Mettals, Plants and Creatures. We read that in the precinct of *Pisa*, a Woman brought forth a Female Child full of Haire like the Haire of a Camell, because (saith the Author) she was wont to kneele before the picture of *Iohn Baptist*, clothed in Camels Haire.

The Secundarie Agent is the Heat or the place of Conception. Heat hauing a fierie mobilitie or quicke motion, formeth sundry shapes of Bodies and worketh the Matter into diuers fashions. The peruerfion also, or the euill Conformation of the place, that is, of the Wombe, may be the cause of a depraued Figure. And thus I make an end of this common place at this time, wherein my purpose was onely to touch the heads of things, reseruing my selfe to hereafter for the particular prosecution. Hitherto we haue intreated of the difficulties which might arise concerning the Conception, now it followeth concerning the Conformation.

QUEST. XV.

Whether all the Parts are formed together.

The difficultie
of the
Question.



His Question is so hard and full of obscuritie, that *Galen* saith it is onely knowne to God and Nature. For what is more diuine then the first conformation of a Man? What more admirable? What more secret? This the kingly Prophet inspired from aboue acknowledgeth, *I will confesse before thee, O Lord, because I am wonderfull made, thy eyes saw me before I was shaped, &c.* Seeing therefore the resolution of this Question is aboue the reach of humane capacitie, which God wot is circumscribed within verie narrow limits: if to make some ouerture thereof I shall take a little more libertie to my selfe, I desire all those that desire with me herein to be informed, not to impute it to my wandring wit, but to the greatnesse of the Subiect. Because therefore as by the Collision of Stones Fire is beate out, so by the ventilation or skirmish of aduersarie opinions the truth comes best to be knowne, we will first with your patience see what the Ancients haue conceived of this matter.

Alcmaeon's
opinion

Alcmaeon thought, that the Braine was first of all formed because it is the seat of Reason and the habitation of the Soule, as also for that in Infants the Head is greater in his proportion then any other of the parts. It may be he had read in *Hippocrates* his *Epidemia*, that the magnitude of the Bones and of all the parts is to be esteemed according to the magnitude of the Head, as if all the rest were formed by the Head, and had dependencie therefrom.

Galen

Galen in the second Chapter of his sixth Booke *De Placitis Hippocratis & Platonis* remembreth that *Pelops* taught publikely that all the Vessels had their originall from the Braine: the same also was the opinion of that *Persian* Philosopher whom *Anicen* calleth *Thesius Perseus*: others *Syamor Cabronensis*.

Pelops.
Theſeus or Syamor.

But because the Braine is onely the Author of sence and motion and the principall Faculties which the Infant hath no need of in his first Conformation, I see no reason why the Braine should be formed before the other Spermatieall parts.

Democrat as *Aristotle* saith in the first Chapter of his second Booke *De Generatione Animalium*, did thinke that the outward parts were first formed, and afterward the inward parts, as Artificers are wont first rudely to frame the modell of Creatures in Wood or Stone before they cut out the more curious lines. *Orpheus* thought that a Creature was formed as a Net is knit, that is in order: *Empedocles* that the Liuer was first formed: the *Stoicks* all the parts together. *Aristotle* in his second Booke *De Generatione Animalium* saith that the Heart is first of all formed, and by and from it all the parts are produced, which (as a Child enfranchised by the Father) taketh vpon him to rule and dispenche the whole Body. This saith he is the first and onely principle, the first liuer, the first mouer, the first that maketh Blood, because it dyeth last of all; now that that dyeth last liueth also first. That the Heart dyeth last, beside that we are taught it by daily experience, *Galen* also confesseth as much in the first Chapter of his sixth Booke *De Locis Affectis*, *Death neuer followeth* (saith he) *vnlesse the Heart be first affected with an immoderate dissemper*. It is therefore necessarie that the Father or Lord of the Family which is the Heart, should be created before the Cater or Steward which is the Liuer. This opinion of *Aristotle*, *Anicen* the Prince of the *Arabian* Family seemeth to follow, which also he establisheth by some reasons: because the Creature cannot be nourished vnlesse he liue and participate of the influence of heat, now the Heart is the plentifull Fountaine of naturall heat.

Democrat.

Orpheus.

Empedocles.
Aristotles.
opinion.

The Heart
dyeth last
after *Galen*
and *Aristotles*

Anicens opinio
on.

Againe, in the first dayes after Conception the formative Facultie needeth no nourishment, because there is no notable resolution or expence in the parts: but of heat and vitall spirits there is alwayes need, therefore it was necessarie that the Heart should be formed before the Liuer.

But this opinion of *Aristotles* is long since cast out of the Schooles of Physitians: For that it is not the onely, nor the first principle we haue already proued sufficiently in the second Question of the Controuersies of the first Booke. Now that it is not first generated may be demonstrated both by Reason and Sence, which two are the most vnpartiall Iudges of all Controuersies. By Sence, because there alwayes appeare together and at once three bubbles, which are the rudiments of the three principall parts, neither did any Man euer obserue one of those bubbles onely. By Reason, because in the first dayes after Conception the *Embryo* needeth not the helpe of the Heart. For liuing the life onely of a Plant, it needeth neither pulsation or spiration nor the influence of heat, because it cherisheth himselfe with his owne heat and with his owne inbred spirit. And whereas *Aristotle* would conclude it to be the first that liueth, because it is the last that dyeth, we say that followeth not: For those things that are first in Generation are not alwayes the last in Dissolution.

Aristotles
opinion.
confuted.

By Sence.

By Reason.

So in the Generation of any thing that is mixed, the Matter goeth before the Forme, and yet the abolition of the Forme is the corruption of the thing mixed. By this reason also in Snakes and Serpents the Taile should be that which liueth first, because when all the other parts are starke dead and immouable, yet the Tayle liueth and moueth. We thinke indeed that the Heart is last of all deprived of life, because when the Infant is perfected and absolued the vitall heat floweth onely from the Heart as from a most plentifull Fountaine; but that it first liueth we vtterly deny: because to liue is either to be nourished or to be animated. The Heart is neither first nourished nor first animated. All nourishment is by Blood, Blood is not but by the Veines, all the Veines are from the Liuer, and the Vmbilicall Veine which is the first Nurse of the *Embryo* poureth the Blood into the *Parenchyma* of the Liuer before that of the Heart. Neither is the Heart first animated because the Seed when it breaketh into act, i. when it beginneth the conformation is wholly and actually animated. Therefore all the parts thereof doe actually liue onely by the participation of heat in the moisture. We bid therefore adue to *Aristotle*, *Chrysippus*, the *Stoicks* and whosoeuer else doe thinke that the Heart is the first liuer and the first maker of Blood.

That the heart
doth not first
liue.

What it is
to liue.

Galen seemeth to differ from himselfe in the order of the Conformation of the parts, for sometimes he saith that the Heart and the Liuer are formed together, sometimes that

Galen in this
isdeters.

The parts are
generated
successively.

the Liuer is first formed, sometimes that the Vmbilicall Veine hath the preheminence, yet herein he is alway of one mind, that he thinketh the parts are generated in succession, not at once and together. And this he illustrateth by examples of those things that are wrought by Art. For a House is not built all at once, but first the Foundations are layd, then the Walls are reared, and finally the Roofe is layd on: so saith he it is in the Infant, one part is formed before another, to wit, that first which is most necessarie for the *Embryo*: and that he thinketh is the Liuer, because the Infant liueth at first the life of a Plant needing onely nutrition as doth a Plant: now the Liuer is the Shop or Storehouse of Aliment. As therefore a Plant hath no need of a Heart, so neither the Infant in the beginning.

Galen.

Moreover that the Liuer is first generated may be proued by the magnitude and the facilitie of his generation, for it is made onely of congealed Blood: add hereto that the Vmbilicall Veine attaineth to the Liuer before it commeth to the Heart. That all these things are true *Galen* teacheth in the third Chapter of his Booke *De Formatione Fetus*, because in Infants the naturall faculties (as being the first of all other) are the strongest, those that rise from the Heart much weaker, those weakest of all which come from the Braine. Furthermore all Generation proceedeth from that which is more imperfect to that which is more perfect: wherefore first is the Liuer generated, then the Heart and last of all the Braine. This is the opinion of *Galen* and almost of all Physitians both old and new concerning the conformation of the parts.

Galen's

opinion

not to be

approved.

The Reasons.

We for our owne part doe not vse to sweare vnto the opinion of any Man, but as we esteeme much and haue in great reuerence the Patrons and Founders of our Art, as becommeth vs well: so if at any time they stray from the rule of right Reason, we shall not make scruple to dissent from them. Whatsoever therefore *Galen* may thinke, we cannot be perswaded that the Liuer is first formed, because before the delineation of all the parts of the Infant he needeth not the helpe of the Liuer; for it was not behoofefull that the Blood should flow till after the discretion and description of the Spermatieall parts, otherwise the Seed would be cloyed and clogged with Blood and in stead of a lawfull Conception a *Mola* would be formed.

As for that nourishment and increase which *Galen* feigneth should be made by the Blood, we are so farre from thinking it necessarie to the first conformation, that we rather thinke with *Hippocrates* and *Aristotle* that it would haue beene a great hinderance thereto, so that we may retort *Galen's* weapon which he vseth against *Aristotle* vpon himselfe. The Infant saith *Galen* needeth not the helpe of the Heart, therefore the Heart is not formed before the Liuer. We say, the Infant needed not the helpe of the Liuer because it is not nourished till after the delineation of the Spermatieall parts is absolued, wherefore the Liuer ought not to be formed before the Heart and the Braine.

Obiection.

You will obiection for *Galen* that life is limited and defined by Nutrition, if therefore the *Embryo* doth liue it needeth to be nourished.

Solution.

I answer, that in Creatures that are perfect nothing liueth that is not nourished, but imperfect Creatures and such as are without Blood may liue a time without nourishment, so some Creatures liue all Winter in holes and a Plant all Winter is not nourished, but viui-fieeth and quickneth it selfe. The tender *Embryo* therefore which is without Blood liueth the first dayes and yet is not nourished, because there is no necessitie of nourishment seeing there is no exhaustion of the parts.

What we

thinke.

It remaineth now that we make manifest vnto you our owne conceit of the order of Conformation, which we will doe as briefly and perspicuously as possible we can: But because we would haue euen the most ignorant conceiue vs the better, we will vse first these distinctions.

Differences
of the parts
of the Infant.

Of the parts, some are proper to the Infant it selfe of which it hath vse in the whole course of his life: others are seruiceable vnto it onely so long as it abideth in the Mothers Wombe, of which kind are those skinny couerings and small Membranes compassing the Infant about. Againe, we must obserue thus much, that some parts are Spermatieall engendered of the Crassament of the Seed, others Fleshy whose originall is immediately from the Blood. And of these Fleshy parts there are three kinds, as there are three kinds of Fleish. For it is either the Fleish of the Bowels which we call *Parenchyma*, or the Fleish of the Muscles, which *Hippocrates* properly and absolutely termeth *carx*, that is, *Fleish*, or the peculiar Fleish of euerie part which hath not any proper name.

The Mem-
branes first
generated.

These things being thus, we conceiue, That the Membranes called *Amnion* and *Chorion* are

are first of all formed, because the inward and most noble part of the Seed was to be defended and walled about with these Curtaines, as we shall shew more distinctly in our next exercise.

These Coats being formed, we thinke that the rudiments or *Stamina* and threds of all the Spermatieall parts are formed together at once, because the Matter is the same, alike altered and disposed by the heat, the Workeman the same, to wit, the spirit diffused through the whole masse of the Seed; the Finall cause the same, that is, the vse of euerie singular part. For, seeing that in the first delineation the Infant needeth not either the nourishment of the Liuer, or the influence or pulsation of the Heart, or the sence of the Braine, but cherisheth it selfe with his owne in-bred heat; why should we thinke that one of the parts is formed before another? If Nature when she vndertaketh the concoction of Quitture or *Pus*, which we call Matter, doth bring the whole to an equallitie together, and insinuates it selfe equally and alike into all the parts thereof; why shall she not in this first delineation of the Spermatieall parts (the Idea of all which the Formative Facultie containeth in it selfe) begin and accomplish the description of all of them together? Neither is this our opinion, but the Conclusion of *Hippocrates* in his first Booke *De Dieta*, and in his Booke *De Locis in Homine*. In his Booke *De Dieta*, *The parts are all delineated together, all together increased, not one or more, before or after another or the rest, but those that are greater by Nature doe appeare before those that are lesse.* In his Booke *De Locis in Homine*, straight after the beginning he breaketh out into these words, *It seemeth vnto me, that there is nothing first in the Body, but all things are the beginning and all things the end, all parts first and all last.* What could he say more plainly? What more briefly? Or what indeed could be either spoken or imagined more Diuine?

All the parts formed together.

Hippocrates opinion.

The Flethy parts are the last made, and their order.

The Spermatieall parts therefore which we call Solid or first parts, are shadowed or lined out at once and together, but afterwards they are perfected euerie one in their order; First, those that are more noble and necessarie, and those last which are most ignoble and lesse necessarie. After the delineation of the Spermatieall parts are formed the Flethy, and first of all the *Parenchymata* of the Bowels, next the proper Flesh of the particular parts, and finally the emptie spaces of the Muscles are filled vp.

Among the *Parenchymata* we thinke that of the Liuer is first gathered together, because the Vmbilicall Veine doth first poure the Blood there-into, which being concreted or caked maketh the substance or Fleth of the Liuer; and this *Haply Galen* meant, where he saith that the Liuer is first generated; so that in this sence if he spake, he may well be excused.

How *Galen* may be excused.

QUEST. XVI.

Whether the Membranes which incompasse the Infant be first formed, and whether they be made by the Forming Facultie, and of the Seed of the woman.

Concerning the originall of the Membranes which compasse the Infant, three things are to be enquired after. First, whether the Formative Facultie doe at these begin the Conformation, that is, whether these be first of all formed. We thinke that they are, being taught both by Reason and Experience.

Three Questions. The first. That the Membranes are first formed. Experience.

For Experience, we will auouch *Hippocrates*, *Aristotle*, *Galen* and our owne. *The Geniture*, saith *Hippocrates*, *after it is mixed and retained, what day or houre soeuer it be added, doth alwayes appeare couered with a Filme or Crust.* The same writeth *Aristotle* in his Booke *De Generatione Animalium*. And *Galen* in his first Booke *De Semine*, *I haue often seene the Geniture conceived onely couered with Membranes.*

Who euer saw a Conception, although it were vicious and illegitimate which was not couered with a Filme as it were with a Garment? The *Mola* albeit it be verie rude and without forme, yet it is cloathed with a Membrane, a manifest argumen, that the Formative Facultie in all Conceptions beginneth her worke with the delineation of the Membranes, though she be hindred that she can proceed no further.

To Experience we may add Reason. The Membranes were necessarily first to be made, that the Seed herein being encompassed might the better manifest his operations, as all that the inward Spirits thereof might be kept from Dissipation and vanishing away, and that the tender *Embryo* might not hurt his soft sides against the hardnesse of the Wombe.

The second
Question.
Whether the
Membranes
are made by
the Formative
Facultie.

Authoritie.

Reasons
against it.

Our resolu-
tion.

The Authori-
tie expounded

The Reason
answered.

The third
Question.
Whether the
Membranes
are generated
of the Mans
Seed or of the
Womans.

The resolu-
tion.

Arantius his
false opinion.

The second Question is more obscure and the more knurrie knot a great deale to riuē, which is, whether these coverings be made by the Formative Facultie? Some thinke that they are generated onely by the heat of the Wombe, and for their opinion doe vrge *Hippocrates* Authoritie and Reasons. For, in his Booke *De Natura Pueri* he writeth: *That the Geniture being heated and puffed is compassed with a Filme, euen as Bread when it is baked is compassed with a Crust.* Now the Crust of Bread or such like is rayfed in the superficies of the Masse onely by the heat of the Fire.

His Reason is on this manner. The Seed containeth in it selfe the *Idea* or Forme onely of those parts from whence it floweth; but in neither of the Parents are there any such Membranes; how then shall the Seed haue any power at all to make or forme them?

But we thinke that the three Membranes are generated by the Forming Facultie of the Seed, and not by the onely heat of the Wombe, because there is no such great heat in the Wombe which in so short a time can burne or puffe the superficies of the Seeds into such Membranes. For if the Wombe should attaine vnto that degree of heat, surely there would be no Conception. So saith *Hippocrates* in his Aphorismes: *Those women who haue hot Wombes doe not conceire*, because when the Wombe is too hot, the Seed is baked and torried as it were.

As for the aboue alleaged authoritie of *Hippocrates*, it maketh nothing against vs; for he doth but illustrate an obscure thing by a similitude or comparison: as if he should say, Euen as the Bread is compassed with a Crust, so is the Infant compassed with Membranes: but that the manner of the generation of these two is alike, that he doth no where affirme: and whereas they say that the Seed containeth onely the *Idea* or Forme of those parts from which it issueth, and that there are no such Membranes actually either in the Father or in the Mother: I answer, that such and so diuine are the powers of the Forming Facultie, that they can diffuse or transfuse themselves out of one Seed into another. If therefore the markes which were in the Body of the Grandfather doe often appeare in the Grandchild, yea in his Posteritie after many degrees of consanguinitie; why shall not the Forming Facultie of the Fathers Seed make an impression in the Infant of that power which the Father himselfe had when he was Seed? Add hereto the necessitie of the Finall cause. For it was behoouefull that the Infant should be inuested with Membranes, and therefore the noble and absolute Architect hath made them.

The third Question which we haue here to discusse, is, Whether these Membranes be generated of the Mans Seed or of the Womans. It is the old receiued opinion, that they are generated onely of the Mothers Seed, because that is the colder and lesse fruitfull, wherefore Nature hideth more inward the noble and especiall parts of the Seed; the more ignoble and base she disposeth on the outside as a defence to the rest: now the Seed of the Woman is more ignoble. Moreouer, the quantitie of the Mans Seed is but little and not sufficient for the forming of the outward and inward parts both, and therefore it prayeth ayd of the Seed of the Woman.

We thinke therefore that for the most part the Membranes are made of the Seed of the Woman, but that they are made onely thereof, that we deny. For if the Seed of the Man be sufficient for the generation of all the parts of the Infant, why should it not also be sufficient to generate the *Chorion*? Again, if the Seed of the Woman doe onely generate these Membranes, how cometh that to passe which *Hippocrates* auoucheth in his first Booke *De Diata*; that when the Womans Seed getteth the victorie ouer the Mans, there are procreated three kinds of Females? Doth not the Womans Seed sometimes ouercome in the permixtion of the Seeds of the Sexes? Therefore when the Womans Seed is stronger then the Mans, why should we attribute the generation of the Membranes vnto the stronger Seed, and of the whole Body of the Infant to the weaker?

We conclude therefore that the Membranes may be generated of either Seed of the Male or Female, but of the Female more ordinarily: and againe that of the Mothers Seed not onely these Membranes but also the Spermatieall parts of the Infant may be formed.

Arantius in the Booke he set out of the Infant saith, that the two Membranes the *Amnion* and the *Chorion* are not generated before all the rest of the parts, but that they are propagations of the inner Coats: the *Amnion* of the Flethy Membrane, and the *Chorion* of the *Peritoneum*. But this is against all experience and reason, as we haue sufficiently shewed in the beginning of this Exercise.

QUEST.

QUEST. XVII.

Of the number of the Vmbilicall Vessels.

IN the Historie of the Vmbilicall Vessels, there are two things obscure, to wit, the number of the Vessels and their originall. Concerning their number the Anatomists are at variance: some say there are onely three, others foure, some five. They which acknowledge three, make onely one Veine and two Arteries. They which would haue foure, add to these three the *Vrachos*. Those who would haue five, number two Veines, as many Arteries and the *Vrachos*.

We resolu, that as well in Men as in Beasts there are foure alwayes, and onely foure to be found. The first is the Veine which is the Nurse of the *Embryo*, which alone & by it selfe arriueth at the Nauell from the Fissure of the Liuer. This Veine, when it hath passed the Nauell is clouen into two and maketh two distinct Channels, and these againe are diuided and subdivided, whose branches being supported by the Membrane called *Chorion*, doe conioyne themselues with the Veines of the Wombe; in Sheepe and Swine by certaine round and Nauell-like Excrecences which they call *Cotyledones* or *Accetabula*; in Women by that bulke of Flesh which the late Anatomists call the Cake or Liuer of the wombe, but I know not for what reason: For I doe not belieue saith *Laurentius* that the Blood is prepared and boyled in that Flesh, but I acknowledge the same vse of it which the Auncients assigned to the Glandulous Body called *Pancreas*, to wit, safely to sustaine and like a Pillow to vnderprop the innumerable propagations of Vessels which are distributed through the *Chorion*. The Veine therefore from the Nauell to the Liuer is but simple and single, which after it is passed the Nauell is clouen in twaine and appeareth double. And thus are the different places in *Galen* to be reconciled, where he writeth sometimes that this Veine is single, sometimes that it is double. The Vmbilicall Arteries are two, one on either side, proceeding not from the Heart but from the *Iliacke* branches of the great Arterie descending. The fourth Vessell remaineth, and vpon this Hinge is the whole Controuersie turned: the Auncients called it *Vrachus*, because by it the Infant poureth his Vrine into the Membrane. Almost all the late Anatomists deny this to be in a Man and say it is onely found in Beasts. Yet I saith *Laurentius*, haue alwayes obserued it euen in Men also: For that a Nervous production is led in Men from the bottome of the Bladder to the Nauell as well as in Beasts, I thinke no Anatomist will deny. I aske therefore what vse is there in Man of this production? Not onely that it may serue for a Ligament (for the Bladder is tyed and doth adhere to the Neighbour parts very strongly by the interposition of many Fibres arising from the *Peritoneum*) but to leade away the Vrine as it doth in brute Beasts? And in this my opinion saith the same *Laurentius*, I am confirmed by the Historie of a Wench whose Vrine being a long time suppressed, did at last issue out at her Nauell. This *Bartholomew Cabrolus* a most expert Chyrurgian, and the ordinarie Dissector to the Colledge of Physitians at *Mompelher* in *France*, hath often made mention of. *Fernelius* also in the thirteenth Chapter of the sixth Booke of his *Pathologia* telleth the like Storie: One there was, saith he, about thirtie yeeres of age in whom the necke of the Bladder was obstructed, and whose Vrine issued plentifully for many months together at the Nauell as it had bene pressed out, and that without any tumor, collection of water in the *Abdomen*, or any offence at all in his health: when many hereat wondered much, and I heard that when he was borne his Nauell was ill tyed and euer after some little quantitie of water issued that way; I conceived that the *Vrachos* was not dryed, and that his Vrine did now as it did when he was in his Mothers Wombe returne from the Bladder to the Nauell.

There are therefore foure Vmbilicall Vessels, one Veine, two Arteries, and the *Vrachus*; all which about the Nauell do meet and are included in a long nervous and writhen Canale like a Gut, which they call the Rope, the Tye, or the Gutling. The reason why they are so incompassed is, that they might not part one from another, and so be either broken being scuered, or intangled if they had scope to intangle themselues. These foure Vessels when the Infant is borne, as now becomming of no vse, doe degenerate into a Ligament. Yet it hath bene obserued that in some after they are growne to good age, the Vmbilicall Veine hath bene changed into a loose and open Veine, as *Volchier Coiser* obserued at *Noriberge* in a Mayden of 34 yeeres old.

Of the number of these Vessels diuers opinions

Our resolution. A description of the Vmbilicall Veine.

Galen reconciled to himselfe.

The Vmbilicall Arteries.

The *Vrachus*.

Proved in Men.

An elegant Historie out of *Fernelius*.

How the four Vessels are tyed together.

A rare obseruation about the Vmbilicall Veine.

QUEST. XVIII.

Of the originall of the Vmbilicall Vessels.

Galen expounded.

Aristotle.

Galen excused.

The opinion of some Anatomists

That the Vmbilicall Veine is not first formed.

What we resolve of.

THE Controuersie is no lesse concerning the originall of the Vmbilicall vessels then it is concerning their number. Some thinke they haue their originall from the Vessels of the Wombe, because they are continuated with them, and are torne from the Infant sooner then from the Wombe. And this same *Galen* seemeth to approue in his Booke *De Dissectione Vteri*. The end of that Vessell which is propagated through the Wombe, giueth beginning to that Vessell which is in the *Chorion*: so that you may see, that these two are one. For they are so vnited by their Mouthes, that the Veine draweth Blood from the Veine, and the Arterie spirit from the Arterie. The same writeth *Aristotle* in the eighth Chapter of his seuenth Booke *De Historia Animalium*: The *Nauell*, saith he, is as it were the Cup of an Acorne about the Veines whose originall is from the wombe; in those Creatures which haue Acetabula from those Acetabula, in those that haue them not from the Veine it selfe. But I thinke *Galen* in the place aboue named tooke more libertie to speake after the common opinion of the multitude not as himselfe thought. For that he might declare the continuitie of the Vessels, he saith, that the end of one Vessell is the beginning of another. A beginning I say not Physicall or Originall, but Mathematicall, that is, Quantitatiue, as the Schoole speakes. Some there are who thinke, that the Vmbilicall Veines and Arteries are first of all generated, and that all the roots of the Veines and Arteries issue from them, because the Veines proceed from the Liuer, and the Arteries from the Heart: now the Vmbilicall Veine is generated before the Liuer; for his *Parenchyma* is not gathered without Blood, and Blood is not deriued but through Canales, and therefore it was necessarie that the Vmbilicall Veine should be formed before the Liuer.

This opinion is indeed verie probable, and so sometimes seemed it to me (saith *Laurentius*) to be, but when I tooke a more serious consideration of the matter, I found it to be otherwise. For how should so many & so notable roots of Veines as are dispersed through the whole *Parenchyma* of the Liuer, arise from so small a branch as this Vmbilicall Veine is? Again, those parts that arise one from another must of necessitie be continued the one with the other. Now there is no continuitie betweene the Vmbilicall Veine and the Hollow Veine, vnlesse it be by the inoculations of the roots of the Gate Veine. What is more absurd then to thinke, first that the *Parenchyma* of the Liuer is made of the Vmbilicall Veine, & afterward that from that *Parenchyma* the roots of all the Veines should arise? Are not the Spermaticall parts delineated before the Fleishy? On the other side, who will say that all the Arteries are propagated from the Vmbilicall Arteries, seeing they reach not directly to the Heart but to the *Iliacke* branches? Would we commend the Builder who would set vp his Walls before he lay his Foundation? I know what will be said, that these Vessels are the roots by which the Infant is nourished after the manner of a Plant, now the roots are first formed. But they must know, that the Infant is not nourished before his Spermaticall parts be delineated, because before that time there is no necessitie of nutrition.

We resolve therefore, that these Vessels are begun together with the rest of the Spermaticall parts, and that the Vmbilicall Veine is a branch of the Gate Veine to which it is continued; that the two Vmbilicall Arteries are Scions or Shoots of the *Iliacke* branches of the descending Trunke of the great Arterie; finally, that the *Vrachos* ariseth from the bottome of the Bladder and ascendeth vnto the *Nauill*. Yet we thinke that the Vmbilicall Veine and Arteries are perfected before the rest of the Vessels, because there was more need of them for the coagmentation or gathering of the Fleish, especially of the Bowels.

QUEST. XIX.

Of the times of the Conformation of a Man and of a Woman-child.

WHich is the first and which is the last day of the Conformation of the Infant, God alone knoweth who made them; and if we haue any thing to say of this matter, we haue it out of *Hippocrates* Fountaines. His opinion is (in his Booke *De Natura Pueri*

Pueri and De Principijs) That the seventh day the rudiments of all the Spermatick parts doe appear, but the perfect dearticulation and description of the Female is in 42 dayes, and of the Male in 30 at the longest. But this we thinke is to be vnderstood onely of the first Conformation; for we doe not belieue that the Flesh of the Muscles is in that space perfected and accomplished, but the third or the fourth month rather, at what time the Infant beginneth to mooue: so that we make a double Conformation, one of the Seed another of the Blood; the first goeth before, which therefore *Hippocrates* in his Booke *De Septimestri Partu* and *De Natura Pueri* calleth *σπέρματος* *σύνθεσις*, the first coagulation or coagmentation; the second doth onely fill vp the distances of the first, that is, the spaces betwene the Threds and the Fibres.

The time of conformation

A double conformation.

Strabo the *Peripateticke* and *Diocles Carystius* dispense the fabricke of the Infant by seuens and seuens, alluding to that maiestie of the Septenarie number which *Plato* conceineth it to carrie in it. Others thinke that 45 dayes is the utmost limit of Conformation. For sixe dayes they ascribe *Spumificationi*, to the frothing of it; foure *Lineationi*, to the delineation; eight to the Repletion of the Lines; fourteene *Carnificationi*, to the generation of Flesh; finally, thirteene *Afformationi*, to the accomplishment. The least time of this processe of Nature is thirte dayes, sixe for Spumification, two for Delineation, foure for Repletion or filling of the Lines, nine for Carnification, and as many for Afformation.

Strabo and *Diocles*.

Others thus in Verse:

Sex sunt in lacte dies, ter sunt in sanguine terni.

Sis seni Carnem, ter seni Membra figurant.

Sixe dayes it is in Milke, in Blood three thrice accounted;

Twelue figure the Flesh, Members sixe thrice amounte.

Hippocrates much more diuinely and distinctly: *Males are formed at the uttermost the 30 day, and Females the 40 or the 42.* Now the reason why a Man-child is sooner formed in the Wombe then a Woman, and yet a Woman out of the Wombe sooner commeth to perfection then a Man, is indeed worth the search. This *Hippocrates* hath left vs in the second Section of his sixth Booke *Epidemion*: *Mas concreuit coaluitq. citius, ubi motus est conquiescit & tardius augetur longioreq. tempore.* A Male gathereth sooner and is sooner articulated, after he moueth he stineth his motion and groweth more slowly and in a longer time. The same also he hath in the third Section of the third Booke *Epidemion*: *That which moueth sooner and is sooner articulated is longer encreasing in his growth.* The demonstration of the truth of this is to be fetched also from *Hippocrates*: *The Man-child is sooner formed in the Wombe because he is hotter, for Conformation is the worke of heat.* And in the first Booke *De Diata*: *Males are generated of hotter Seed, Females of colder.* And in his Booke *De Natura Pueri* in expresse words: *This is the reason why a Female is formed and articulated later then a Male, because the Seed of the one is moyster and weaker then the Seed of the other.* Add hereto the nature and condition of the place, for Males for the most part are generated in the right side, Females in the left, as appeareth in the 48 Aphorisme of the first Section: *Now the right side is hotter then the left.*

Hippocrates. Why the Male is sooner formed in the Wombe.

But why the Female out of the Wombe is sooner perfected, we must seeke for a demonstration out of *Aristotle* in his Booke *De Ortu & Interitu*. *The times of perfection and imperfection ought to be proportionably answerable one to another; corruption is an imperfection, but accretion and generation are accounted kinds of perfection; what soeuer sooner perisheth attaineth also sooner his perfection.* So an acute and short disease runneth suddainly through all his foure times, and commeth sooner to his heighth or pitch then a chronicall or long disease. Now for the most part and generally Women dye sooner then Men, as being of a shorter life because the principles of their life are weaker, and therefore they also doe sooner attaine the perfection of their life. To this we may add the softnesse of their Bodyes which makes them more apt for extension.

Why the Female is sooner perfected out of the Wombe *Aristoteles* Reason.

Hippocrates who was ignorant of nothing, in his Booke *De Septimestri Partu*, expresseth this briefly and plainly in these words: *After Females are separated from their Mothers (that is, are borne) they cotten sooner then Men, grow sooner wise and sooner old; as well because of the weakenesse of their Bodyes as by reason of the manner of their life.* He therefore acknowledgeth a double cause; the first is weakenesse, so that that which in the Wombe was the cause of their slower conformation and motion, the same is the cause out of the Wombe of their more suddaine and accelerated perfection. For a Female is a thing more imperfect then a Male, and hath her end nearer then he, and therefore needeth not so long a worke of Nature. The other cause is the manner of their dyet and course of life; for their life is idly led in want of exercise. Now slothfulnesse, saith *Celsus*, dulbeth the Body, labour strengtheneth it;

A double Reason assigned by *Hippocrates*.

Celsus the

Hippocrates.

NOT ANNOT.

the first maturateth or hasteneth old-age, the second prolongeth youth. Neither, saith Hippocrates in his Booke *De Victus ratione in Morbis Acutis*, can a Man enjoy perfect health unless he labour his Body and take paines. And in the fourth Section of the sixth Booke *Epidemion*. The best way to maintaine health, is to eat vnder facietie and to be free and diligent at labour.

QUEST. XX.

Whence it commeth that Children are like their Parents.

A three-fold
forme.

A three-fold
similitude.

What is the
similitude of
the species.

What is the
similitude of
th: Sexe and
whence.

A three-fold
generation of
Males out of
Hippocrates

A three-fold
generation of
Females.

The similitude
of the
Individuum

AS among Philosophers there is a three-fold forme of euerie Creature: the first specificall; the second of the Sexe; and the third of the *Individuum* or particular by which it is that and no other thing: So among Physitians there is a three-fold similitude: the first in *specie*, i. in the kind; the second in the Sex; the third in the fashion or feature or indiuiduall figure.

The similitude of the kind they call that, when a Creature of the same kind is procreated as a Man of a Man, a Dogge of a Dogge: for euerie thing worketh not vpon euerie thing, neither doth euerie thing suffer by euerie thing; but euerie Agent worketh vpon his determinate Patient; and therefore of the Seed and Blood of a Man onely a Man is made. In this specificall similitude there is much attributed to the materiall cause, and that is the reason why the Of-spring is vniuersally liker to the Female then to the Male, for the Female affordeth more matter to the generation then the Male: so of a she Goat and a Ram is generated a Kid not a Lambe, of a Sheepe and a he Goat a Lambe not a Kid.

The similitude of the Sex (that is why a Male or Female is generated) hath for cause the Temper of the Seed, his mixture and victorie. For if the Seed of both Parents be hot Males are generated, if cold Females. If in the permixtion of the Seeds the Male Seed haue the vpper hand a Male is procreated, if the Female Seed a Female. This first of all Hippocrates taught in his first Booke *De Dieta*, where he acknowledgeth in either Sex a double Seed, the one Masculine hotter and stronger, the other Feminine that is colder, out of the diuers permixtion of which, both Males and Females are generated.

He therefore thus distinguisheth a three-fold generation of Males and Females. If both the Parents yeeld a Masculine Seed they breed Male Children of a noble and generous disposition, *καὶ τὸ σῶμα ἰσχυρὸν*, Nobly minded & strong of Body. If from the Man there issue Masculine Seed from the Woman Feminine and the Masculine preuaile a Male will be generated, but lesse generous & strong then the former. If from the Woman there issue Masculine Seed, from the Man Feminine and the Masculine ouercome a Male will be generated, but womanish, soft, base and effeminate. The verie like may be said of the generation of Females: for if from both the Parents doe issue Feminine Seed a Female will be procreated most weake and womanish: Which Hippocrates in the first Section of his sixth Booke *Epidemion* calleth *ὑδαρινὸς*, *Aquefcentes*, soft, waterish & loose Bodyes. If from the Woman proceed a Feminine Seed and from the Man a Masculine and yet the Feminine ouercome, Women are begotten bold and moderate. If from the Man proceed Feminine Seed and from the Woman Masculine, and the Womans Seed preuaile, Women are begotten *τολμηροτερὰ καὶ ἀνδρείαι*, that is fierce and mannish. The Temper therefore of the Seed and the victorie in the permixtion are the causes of the similitude of the Sex, that is of Males and Females; which causes are also not a little assisted by the Temper of the Wombe and the condition of the place, for as I haue often said, Male Children are borne in the right side, Females in the left.

The third similitude remaineth, which consisteth altogether in the Figure, Forme and Accidents of the *Individuum*. This Galen in his second Booke *De Semine*, will haue to consist in the differences of the parts & in the conformation of the Members. By this, one is white another blacke, one hawke-nosed another flat or saddle-nosed. In this similitude of the *Individuum* consisteth all the difficultie of this Question, which we will mince as small as we can that it may be digested without labour, from hence taking our beginning.

The Infant sometimes is altogether like the Mother, sometimes altogether like the Father, orher sometimes like them both, that is, in some parts resembling the Mother, in others the Father. Oftentimes he resembleth neither the Father nor the Mother, but the Grandfather or the great Grandfather, sometimes he will be like an vnknowne friend, as for example,

ample, an *Aethiopian* or such like who neuer had hand in his generation. Of all these similitudes we haue many examples in Authors of approoued credite.

The People called *Cannata* haue common Wiues, and euerie Man chuseth his Children or refuseth them as they are more or lesse like vnto himselfe. Among the *Chimians* the Children are like their Fathers in their Nose, their Eyes, their Forehead and their Beard. There haue beene in certaine Stockes and Tribes signes which they called *Signa Gentilitia*, that is, Stocke-markes, as to the *Spartanes* and *Thebanes* a Launce, some had a Starre, *Thyestes* a Crabbe, which were imprinted in their Bodies from their birth; and these sometimes were extinguished in their Children and Grandchildren, but after a long time appeared againe in their Posterities.

Selucus and his Posteritie had in their Thighes the fashion and representation of an Anchor. *Julia* the Daughter of *Augustus Caesar*, although she playd false and had many Copesmates, yet all her Children were like her Husband. Being asked what Art she had for that conueyance, she answered wittily and in some sort honestly in respect of others of her profession: *That she neuer tooke in her passengers till her Ship were full fraughted.* I passe by what might be said of the *Lensuli* and the *Macrocephali*: It will concerne vs more to spend our time in the search after the causes of these things.

The cause of this similitude or likenesse of the Forme and feature is verie obscure and full of Controuersie. *Empedocles* the *Pythagorean* referreth the cause of this likenesse onely to the Imagination, whose force is so great, that as it oftentimes changeth the Body of the Imaginer, so also it transferreth his efficacie into the Seed conceived. The *Arabians* attributed so much to Imagination, that they thought the Soule might so farre be eleuated by Imagination, that it should not onely worke vpon it owne Body, but also vpon an others: and that Soules so eleuated and enobled were able to change the Elements, to heale diseases, to weaken whom they listed, to worke myracles, and finally to exercise a kind of command ouer all kinds of matter. *Aristotle* in the twelfth Probleme of his tenth Section, acknowledgeth this power of the Imagination in the Conception and Infant conceived. For he asketh the question why the off-spring of Men are so vnlike one to another: and maketh answer, because in Man the swiftnesse of the cogitation and the varietie of their wits did imprint many and diuers markes and seuerall Impressions.

Galen in his Booke *De Theriaca ad Pisonem*. I counselled (saith he) an *Aethiopian* that he might beget a white and beautifull Child, to set at his Beds-feet a faire Picture, vpon which his Wife might wisely looke in the time of her conception. He obeyed my counsell and obtained his desire. And that was the reason why *Hesiodus* forbade Women to haue companie with their Husbands when they returned from a funerall, but when they came from bankets and disports. For the illustration of this we haue a Storie of a Sabine wife, of whom *S. Thomas More* wrote an elegant verse. And *S. Hierome* in his Questions vpon *Genesis* maketh mention of a Woman who was suspected for an Adultresse because she brought forth a Child no way like her Husband, but cleared her honestie because she shewed a Picture in her Chamber like the Child she brought forth. Thus *Iacob* in the 30 of *Genesis* cunningly made the greatest part of the Flocke of a spotted Fleece, by laying before the Ewes spotted Rods. *Pliny* in the seventh Booke of his Naturall Historie remembreth many examples to this purpose, and *Fernelius* in the seventh Booke of his *Physiologia* conceiueth, that the Imagination onely is the cause of this similitude of the feature, by which alone he thinketh the Facultie which formeth the Figure is led and gouerned.

But me thinkes it is verie hard to make the Imagination the onely cause of this similitude. For, neither the Imagination nor any other Facultie which hath knowledge ioyned thereto is able to worke vnlesse it haue his obiekt present by which it may be mooued. Now we know that a Child often resemblenth one whom the Mother neuer knew. Add hereto, that in the coition all the Animall Faculties are almost intercepted, so as the Forming Facultie can scarce receiue or conceiue those Imaginations.

Againe, if the Imagination alone were the cause of the similitude then no Infant should be deformed, neither should they be troubled with hereditarie diseases: for no Mother wisheth or imagineth euill to her owne Children. The Astrologians referre the cause of the similitude to the Starres. For (say they) as often as the Sunne is in the Center of the Horoscope and the Conception is in the day time, so often are Sonnes begotten like their Fathers: And Daughters like their Mothers when the Moone is with the Center of the Horoscope if the Conception be by night, or when *Venus* is with

Diuers examples of this similitude.

The first opinion of them that referre this likenesse to the Imagination. The Arabians opinion

Aristotle

A Historie out of *Galen*.

S. Hierome.

Iacob.

Fernelius

That it is not the Imagination alone

The Astrologians,

the

Their opinion
that referre it
to the motion
of the Seed
Aristotles
subtle Philo-
sophy

Made plaine
by an instance

Galens
opinion

Erasmus
opinion

What our re-
solution is

What the formative faculty can do,

the Center of the Horoscope if the Conception be by day. But these are meere vanities.

There are others who referre the cause of this likeness onely to the motion of the Seed, and to the Formative Facultie. And this is *Aristoteles* opinion in his fourth Booke *De Generatione Animalium*, and *Galen* in his second Booke *De Semine*.

Aristotles Philosophy concerning this point is indeed verie wittie and excellent, but withall verie obscure. For he saith, that there are in the Seed many Motions; some are Actuell, some Potentiall. The Actuell motions are either Vniuerfall or Particular: Vniuerfall, which generate a Creature or a Man; Particular, which generate Males, and those such, that is, of such a Forme, Magnitude of Members, Lineaments and Habite. Those Motions which are Potentially in the Seed doe proceed from the Grandfather, great Grandfather and the Mother. If one of these Motions, to wit, that which is nearest and most particular be intercepted, then is transiſion made into the next motion, and if that be deficient, transiſion is made into the contrarie, and at length into the Vniuerfall. These distinctions of Motions which I doubt not seeme vnto you confused and intangled we will make more manifest by an example. In the Seed of *Socrates*, there is a power to beget a Male child like vnto himselfe: the Seed therefore is moued toward the forme of *Socrates*. This Motion, if it be hindred either by the Seed of his Wife which haply is stronger then his, or by the coldnesse of the Wombe, or by any other cause: then is that first motion of the Father dissolued and lost which was actually in *Socrates*, and transiſion is made into the motion of the Grandfather or great Grandfather which was not in the Seed of *Socrates* Actually but Potentially, and so the Child becommeth like *Socrates* Father or his Grandfather: if this second motion be interrupted then is transiſion made into a contrarie motion, that is, into the motion of the Seed of the Mother, which *Aristotle* calleth Contrarie, because Nature at the first hand and of her selfe euer intendeth the generation of a Male. Wherefore, in the stead of a Male shall then a Female be procreated like vnto the Mother, or the grandmother or the great Grandmother, whose *Effigies* or representation the Seed of the Woman potentially containeth. This third motion if it be intercepted, finally there is transiſion into an vniuerfall motion, and a Man shall be borne indeed, but like neither Father nor Mother.

Galen in his second Booke *De Semine* doth not acknowledge these so diuers motions of the Seed, but referreth the causes of the similitude to the temper of the Seed, and the diuers permixtions thereof, as also to the strength of the Formative Facultie. That learned Man *Erastus* referreth the cause of this indiuiduall similitude onely to the Formative Facultie, quire excluding the power of the Imagination, because he perceiued that blind Creatures brought forth young like vnto their Sires. *The Formative Facultie* (saith he) *hath no need of a Patterne: For as in the Seed of Lettuce that Facultie being therein, generateth and formeth a Lettuce without a Patterne: So in the Seed of a Man, the Formative Facultie accomplisheth his worke without any Patterne or Imagination at all.* But what will *Erastus* say to that white Woman who attentiuely fixing her eyes vpon the Picture of an *Aethiopian* brought forth a blacke Child? What to her that brought forth a hairie Child by looking often vpon the Picture of *S^t Iohn Baptist* cloathed in Cammels haire?

We, that through the waues of this turbulent Sea of opinions we may ariue in a safe Harbor, will acknowledge a double cause of this diuers similitude, which is in the Feature, Forme and Accidents of the *Individuum* or particular Creature. The one ordinarie which alwayes worketh vnlesse it be interrupted, and this is the Formative Facultie ingenite with the Seed: the other extraordinarie which doth not alwayes concurre to generation, but commeth from without and is more noble then the former, because it hath power ouer it now and then and setteth a new seale vpon the tender and soft nature of the Child, and this we call Imagination or Cogitation.

That first Forming Facultie because it containeth in it selfe the *Idea* of all the particular parts, if it worke freely and at libertie and be not interrupted by any thing in the whole time of the conformation as it hapneth in other Creatures and in Plants, it euermore setteth that stampe vpon the Infant which is in the Seed it selfe, and so the Children become alwayes like vnto their Parents; wholly to the Father if the Fathers Seed doe alwayes and totally ouercome; and altogether to the Mother if the Mothers Seed haue the victorie: In some parts to the Father, in others to the Mother if any part of the Seed of either be ouercome by the other. For though the Seed appeare to the view *Homogenic* yet hath it some parts more thicke others thinner.

Sometimes the Children represent the Grandfather or great Grandfather, because there lurkes yet in the Fathers Seed some facultie deriued from them. For *Aristotles* opinion is, that the *Species* or forme of the Parents may be extended to the fourth Generation: And euen as a Loadstone shooteth forth his force and efficacie through the Needles hanging one at the end of another to the fourth or beyond, so that Formatiue Facultie is transmitted from one Seed to another. So *Helis* who accompanied with an *Aethiopian* did not bring forth a black Daughter, but yet that Daughter of hers brought forth a blacke Sonne. And *Nicaus* the Poet of *Constantinople* though begotten of white Parents, did degenerate into the colour of his Grandfather who was an *Aethiopian*.

If therefore the Formatiue Facultie worke at libertie it will alwayes generate Children like the Parents; but if in the beginning of the conformation the Formatiue Facultie be hindred by another which is more powerfull and diuine then it selfe, such as is the Imagination, then will the Impression follow not the weaker but the stronger, and so the Infant will become vnlike the Parents. For the Imagination commandeth the Forming Facultie, because the Formatiue Facultie is but a production of the procreating power which is Naturall; but the Imagination is a principall Facultie: now what Imagination can doe as well in the conformation as after it we haue touched already, to which we will add these things to make vp the Question with.

Oftentimes the Imagination of that thing is imprinted in the tender Infant which the Mother with Child doth ardently desire, which is onely to be imputed to the strength of the Fancie. For the reall *Species* of a Figge or a Mulbery is not transported to the Wombe, but only the spirituall forme or abstracted notion, which is sooner fastned vpon the Infant then vpon the Womb, because an impression is sooner made in soft Wax then in hard Iron.

Furthermore, the manner of this impression *Auiscn* hath expressed in his first Booke *De Animalibus*, where he saith, That a strong Imagination doth instantly moue ayrie spirits which are mouable of their owne nature, and in these it setteth the stampe of the thing desired; the spirits being mingled with the Blood which is the immediate Aliment of the Infant, doe imprint in it the same Figure they receiued from the Imagination. But how the spirits should so suddenly receiue and apprehend the *Spectra* or Images represented by the Imagination, belongeth to a higher contemplation. Our opinion is, that as the Forming Facultie in the Heauens of those Creatures whose generation is equiuocall, is imprinted in the Aire; after the same manner the formes of the Imagination are insculped or engrauen in the Airie spirits. As therefore the Aire is full of formes (as we shall shew more at large when we come to the nature of the Sight) so our Spirits which are airie doe easily admit all *Species* or formes of things. So the Seed by reason of the Spirits which wander and gad vp and downe through all the parts of the Body doth containe in it selfe, as we haue shewed already, the *Idea* or Images of all the particular parts.

QUEST. XXI.

How Twins, or more Infants are generated.

THE Immortall God of his Diuine Prouidence hath giuen almost to all brute Creatures a power to bring forth many young at once lest their kinds should be extinguished, for that of themselves they are but short liued, and beside serue Man for food and rayment, yea prey also one vpon another. Man the most temperate and of longest continuance, by the prescript of Nature breedeth but one Infant at once, or at the most but two; because there is but one bosome in the Wombe of a Woman; but two parts thereof the right and the left distinguished onely by a line, not dissuered by any partition; and onely two Duggs appointed to nourish two Infants which we call Twins. And if at any time a Woman bring forth three or more, that seemeth to the Philosophers to be *para phisicis*, vnnaturall.

We haue many elegant Histories of such manifold burthens. In *Egypt* where *Nilus* that fruitfull Riuer runs, Women bring sometimes fixe at a birth. *Aristotle* in his seuenth Booke *De Historia Animalium* affirmeth that one Woman at foure birth brought into the World twentie all perfect. *Trogus* reporteth, that in *Egypt* it hath beene knowne that a Woman hath borne seuen Infants at once. *Albertus* telleth a Tale of a Woman in *Germany* who

How children become like their Progenitors.

Histories

What the Imagination can doe in this Similitude.

Why and how the impression is made vpon the Infant.

Answer out of *Auiscn*.

How the spirits receiue the impression of the imagination.

Why man engendeth not so many young as brute beasts

Histories of manifold Infants at a birth

How children
become like
their fathers

The cause of
Twins,

Why and how
the institution
is made open
the future

Asclepiades
opinion.
Anicetus
opinion

Whether in
one coition a
Male and a
Female may
be conceived

Three ques-
tions:

having 22 Infants formed in her Wombe suffered abortment, and of another who had at once 150, all of them being as bigge as a Mans little Finger. *Margaret Countesse of Holsteid*, is said to haue brought forth at one burthen 364 living Infants, who were all christned but dyed presently after: the Males were named *John*, and the Females *Elizabeth*. There remaineth to this day a Marble Sepulchre of hers in a Monasterie in *Holland*. There are also many other Histories of such-like burthens as these, which I willingly pretermitt, being more willing to spend my time in searching out the causes of them.

Many of the Ancients referre the cause of Twins and manifold burthens to the varietie of the bosomes of the Wombe, for they make seuen bosomes in the Wombe of a Woman, which they call *celae* or Cels: three in the right side of the Wombe appointed for Male children, and three in the left appointed for Females, the seuenth in the midst wherein Hermaphrodites are engendred: but these are idle conceits, next a kin to old Wiues tales. For in a Womans Wombe there is but one bosome, as there is but one cauitie in the Stomacke, which yet may be diuided into the right side and the left. These sides are disseuered by no partition, whatsoever *Auicenna*, *Galiabbas* and many other Anatomists doe auouch, as they are in Sheepe, but onely distinguished by a Line, which *Aristotle* calleth *Septa*, that is, *A middle Line*, which word he tooke out of *Hippocrates* in his *Coaca Praenotiones*. Moreouer that the varietie of Cels cannot be the cause of the multiplictie of the burthen, that among other things may be an argument, because sometime twentie young ones or more may at once be conceived, but no Man I thinke will say there are so many bosomes in the wombe; neither yet in other Creatures are there so many bosomes as there are young, as appeareth in Fishes who haue an infinite number of Spawne, yet no partition or distinction betweene them. *Erasistratus* referreth the cause of Twins to a repetition of conception. *Empedocles* vnto the plentie of Seed: *Ptolomy* to the diuers position of the Starres. The true cause *Hippocrates* acknowledgeth in his first Booke *De Dieta*, to be the diuision of the Seed. So it was necessarie that the Seed be diuided equally into both sides of the Wombe. For oftentimes in coition, all the Seed is not at once eiaculated but by fits or turnes; so saith our Master: neither doth the Seed alwaies issue at once, but it boyleth & is eiaculated at twice or thrice. A part therefore of the Seed falleth into one side of the Wombe, and another part into another, and so Twins are conceived.

Asclepiades referreth the cause of Twins to the excellencie of the Seed, which if it be strong is able to make many Infants. *Auicenn* addeth as another cause, the motion of the Wombe, which draweth vnto it selfe the Seed of a Man & disposeth it diuersly, bestowing the parts of the Seed in this side and that side of the Wombe from whence comes a multiplicitie of Conceptions. And these are all the causes of Twins or many Infants. But that their Conception and Conformation may the better be manifest, we are to discusse three Questions. The first, whether at the same coition a Male and a Female may be procreated. Secondly, whether Twins are included within the same Membranes, and contained in diuers places. Lastly, why Twins are commonly so like one another: and all these we will resolue out of *Hippocrates*. For the first, we say that at once two Males, two Females, a Male and a Female may be conceived at one and the same coition. The manner is thus expressed by *Hippocrates* in his first Booke *De Dieta*, and in his Booke *De Natura Pueri*: If from both Parents Masculine Seed doe issue, then are two Males generated; if Feminine Seed, two Females; if both Masculine and Feminine, then of the Masculine is a Male conceived, and a Female of the Feminine. Moreouer, Twins that are both Males or both Females doe for the most part suruiue, but if they proue a Male and a Female, the Female doth scarce suruiue, or at the least is verie weake, because it is not formed and perfected at the same time wherein the Male is formed and perfected. This *Aristotle* expresseth verie plainly in the sixth Chapter of his fourth Booke *De Generatione Animalium*: If the Twins be a Male and a Female they rarely suruiue, because this duplication in Men is vnnaturall, for that the Male and the Female are not distinguished in the same time, vnlesse the Males conformation be fore-slowed, or the Females ouer-hastned.

The second Question *Hippocrates* answereth in his Booke *De Superfætatione*: The Woman, saith he, that is with Child with Twins, trauelleth of them both in one day, and if they be both of one Sex they are contained in one after-birth. Wherefore the Twins of the same Sex are wrapped in the same Membranes, yet each of them haue their particular Umbilicall Vessels: but if they be of diuers Sexes they haue their diuers Coats. Again, if they be both of one Sex they are carried in the same side of the Wombe, two Boyes in the

the right side, and two Wenchies in the left; but if they be of different Sexes, the Male shall be concluded in the right side of the Wombe, and the Female in the left.

The third Question was, why Twins are so verie like one another. *Hippocrates* in his first Booke *De Diata*, acknowledgeth a three-fold cause of this similitude. First of all, saith he, the places wherein they receiue their augmentation are equall, whether they be conceived in the right or in the left side of the Wombe, because by a wonderfull prouidence of Nature, the right are equall to the left, that so the whole Body might be *ισογενετον*, that is, equally ballanced; againe because they are conceived together; lastly because they vse the same Aliments, for they sucke the same Blood and enioy the same Vitall Spirits which they draw from their Mother by the Vmbilicall Arteries. And thus much of Twins, now we proceed to *Superfætation*.

QUEST. XXII.

How Superfoetation is made, why onely a woman when she hath conceived desireth the companie of the Male, and by what wayes she then eiaculateth Seed.



Here are so many difficulties concerning the nature and manner of *Superfætation* that many Men haue imagined there can be no such thing, but we must not giue care vnto them. For *Hippocrates* wrot a Booke *De Superfætatione*, and there is a notable example of *Superfætation* in his first Booke *Epidemia*: In a Woman of *Larissa*, who the fortieth day after her deliuerance of a legitimate Child auoyded another preposterously conceived. Famous also is that birth of *Alcmena*, when she brought forth *Hercules* and *Iphiclus* his Brother after him. *Aristotle* in the fifth Chapter of the fourth Booke *De Generatione Animalium* saith, that some Creatures admit *Superfætation*, others doe not admit it: and of these that doe, some are able to nourish both burthens, some are not able sometimes, at other times they are able. And in his Booke *De Historia Animalium*, he alleageth some examples of *Superfætation*: A certaine Adulteresse, saith he, brought forth one Infant like her Husband, another like the Adulterer. Another being with Child with Twins had a third by *Superfætation*. Another brought forth one the seuenth month which dyed, and in the ninth was deliuered of two others which did suruiue. *Galen* makes mention of *Superfætation* but seldome. *Rhazis* 22, *Continent*, *Alzaranius* and *Auicenna* are all of opinion, that those Women are subiect to *Superfætation* who whilst they are with Child haue their Courtes. *Pliny* in the eleuenth Chapter of his seuenth Booke writeth, That *Procennia* a Seruant-Maid accompanied the same day with her Master and his Man, and conceived by them both, and bare either of them a Sonne like to the Father. That another was deliuered of a Child at five months and went out her iust time with a second. That another was deliuered of a Child at seuen months and went out her whole time with two Twins beside. *Dodoneus* in his Obseruations, telleth Stories to the same purpose. We conclude therefore, that there may be *Superfætation*. Now this *Superfætation* is nothing else but a second Conception, when a Woman already with Child accompanying with a Man conceiue againe, as if it were a new Conception aboue another before conceived. This *Superfætation* or iterated Conception is not common to all Creatures, as *Aristotle* teacheth in his fourth Booke *De Generatione Animalium*: To Women it hapneth oftner then to other Creatures, vnlesse it be Hares and Swine; notwithstanding whensoever it hapneth, it is beside the ordinarie course of Nature.

Now the reason why *Superfætation* hapneth most in Women, is because Women (and they almost onely) after their Conception doe desire the companie of their Husbands. Other Creatures when they are pagled, as we say, doe neuer or verie seldome admit the Male: but what may be the reason hereof? *Dionysius* in his Commentaries vpon *Hippocrates* Booke *De Natura Pueri* saith, That other Creatures after they haue conceived, doe not desire the companie of the Male, because all that which should be the matter of new Seed is consumed in the nourishment of their young, and therefore they are not goaded with their wonted lust. But a Woman, because she hath in her abundance of moysture, hath also her Vessels full of Seed, from whence comes the motion and sence of the obscene parts. But this reason I cannot approue. For although the Infant doe consume almost all the reliques or surpluse of the Blood, yet doth it not defraud the parts of the Mothers Body

Divers exam-
ples of Super-
fætation.

What Super-
fætation is.

Why Super-
fætation belon-
geth most to
Women.

Dionysius.

Disfringed.

of their conuenient nourishment; neither taketh from the Testicles their proper facultie of drawing and altering the Blood. So Women at 60 yeeres old haue no surplufage of Blood and therefore their Courfes faile; yet they continue to procreate Seed euen to their extreme age, which also in coition they auoid, which though at that age it be not fit for generation, yet it is sufficient to prouoke pleasure.

The true cau-
ses thereof.

First.

Second

Poppea her a-
cute Answers.

How Super-
satiation is.

Hippocrates.
The opinion
of some

Confuted.

Another
opinion
of the new
Writers.
Reason. I.

Disproued.

The first
Reason
satisfied.

The second
Reason
answered.
Two passages
of Seed.

We acknowledge other causes of this disposition of Women and those naturall. For the Morall causes of which *Lactant.* writeth in his Book *De Vero Cultu* we leaue to Diuines. The first is, the scituation and conformation of the Wombe: for in other Creatures when they are great with young the Wombe is nearer the outward parts, and therefore more in danger to be violated by the Male whose Genitals are of a great length, and for the most part of a harder substance. But a Womans wombe is scituated further inward and beyond the Mans reach and therefore she beareth him the more easilier. Againe, to Beasts the vse of *Venus* is onely giuen for the preseruacion of their kind; if therefore they conceiue, the finall cause being satisfied their desire of coition is also appeased: but Man vseth these pleasures not onely to propagate his kind, but also to sweeten and mittigate the tedious and irksome labours and cares of his life. *Poppea* the Daughter of *Agrippa* being asked this question, *why Beasts did not copulate after they had conceived?* Her answer was, *Because they were Beasts.* And truly the answer beside the quicknesse of it was not amisse; for it is a prerogative which Nature hath giuen to Man aboue other Creatures. But to returne to our Question. It appeareth therefore that the reason why *Superfatiation* is more ordinarie in Women then in all other Creatures, is, because when she hath conceived yet she may desire the societie of the Male. Now let vs enquire how this *Superfatiation* may be.

Most certaine it is that the Wombe is so greedy of Seed, that after Conception it is so contracted that there is no void space left in it, and the inward Orifice so close shut that nothing can passe into it or issue out of it. This *Galen* teacheth vs in many places, and *Hippocrates* in the 51 Aphorisme of the fifth Section: *Those that are with Child haue the mouth of their wombes closed.* How therefore can it be that the Seed of the Male can arriue into the bosome of the Wombe to make a second Conception? There haue beene some of the Ancients who dreamt that by a wonderfull prouidence of Nature, the Wombe at certaine times did open it selfe to auoid those things which might otherwise offend it; at which times if a Woman with Child should accompanie with a Man, the Wombe might entertaine his Seed, and so breed a *Superfatiation*. But I take these to be but idle and addle imaginations: For if through the whole courle of those nine months the Wombe should at certaine times open it selfe to expell that that is superuacuous; why then are the *Lochia* (i. those Purgations which issue after Trauel) retained all the time in the wombe? or can the wombe at the same time that it auoideth that wherewith it is offended, receiue also the Seed whereby it is pleased and conceiue the same? Rather the Seed would so be extinguished.

Among the late Writers there are some who thinke that the Wombe is neuer so exquisitely shut, but that it may admit Seed; which their opinion they establish by these reasons. When Women are with Child they often auoid their Courfes Pallid, Flegmaticke or Blacke, which out of question lay lurking in the cauitie of the Wombe, and therefore the Orifice thereof is not so perfectly shut.

Againe, a Woman with Child in coition looseth Seed, which she perceiueth to issue from her by her lap, which way it could not issue vnlesse it came thorow the necke from the cauitie of the Wombe, because a Woman eiaculareth her Seed by the sides into the bottome of her Wombe. The Orifice therefore of the Wombe is alwayes open and so hapneth *Superfatiation* the more easily. With these arguments they thinke they haue won the cause, whereas for want of skill in Anatomie they cast a mist ouer *Hippocrates* Sun-shine. For that I may answer their first argument. It is manifest by this manner of reasoning that they are ignorant, that there are two Veines which disperse their branches through the Wombe, some of which are carried to the inward cauitie thereof by which the Infant is nourished, others run to the outward part of the Wombe euen vnto the necke and the lap it selfe. By these all the time of their ingrauidation or in which they goe with Child, the Blood issueth and the superfluties of the Body are purged without interruption, although the inward Orifice of the Wombe be neuer so closely shut. Their latter reason would vrge more but that we find two passages whereby the Womans Seed is auoyded. The first passage determineth in the hornes or sides of the Wombe by which the Seed is eiacularated into the bosome of the wombe when a woman is not with child, for it is the shorter & the opener way.

The

The other passage was vnkknown to the Ancients and to many also of the later Anatomists, but easie to be obserued in Dissection if it be diligently sought for. It ioyneth with the former but is longer, and runneth along the sides of the Wombe and the necke and endeth in the lap. By this passage we belieue that Women with Child doe auoid their Seed, and therefore doe conceiue greater pleasure in their Husbands companies, because the Seed runneth a longer course through the Vessels and beside through the Membranous necke of the Wombe, both which are of exquisite fence.

The manner of *Superfetation*, Hippocrates first of all opened in his Booke *De Superfetatione*, where he saith: *Superfetation hapneth to those Women, the mouth of whose wombe after their first Conception is not close shut.* For if at that time a Woman doe againe accompany with her Husband, she will easily receiue his Seed and lay it vp in the bosome of the Wombe, from whence commeth a second Conception. Now this must be vnderstood of the third or fourth day after the first Conception, for the Wombe cannot abide open all the time of Conformation.

But a Question may be asked whether *Superfetation* may happen after the first, second or third month of the first Conception, as many Men doe write and alleage many examples therefore?

We answer, we thinke it may so happen but very rarely: for the Wombe may be so enraged, that it may open againe and receiue new Seed, and yet the former conception not be violated if the Woman be sound and the Infant strong, as well because it is firmly tyed to the wombe, by the mouth of the vessels, as also because as yet it seeketh not to be enlarged.

This we (saith *Laurentius*) haue sometimes obserued in Twins. *I saw (saith he) a noble Woman conceiued of two Twins, who first was deliuered the first day of the ninth month of a dead Child, and the seuenth day after of another aliue.*

The like Historie there is in Hippocrates seuenth Booke of his *Epidemia*, whose words are these: *Terpida a woman of Doriscus (a Citie of Thracia) when she had gone with Twins siue months, by some mischance suffered Abortment, the one issued forth presently compassed with a Membrane, the other she went with about fourtie daies after.* The inward Orifice of the Wombe may therefore be opened, and yet the Infant remaineth behind. We haue also for this the authoritie of Hippocrates in the 38 Aphorisme of the fifth Section, where he saith: *A Woman with child with Twins, if either Pap fall and grow loose, she will abort of one of her Children: if it be the right Breast, of a Male, if it be the left Breast, of a Female.* The Infant therefore may be retained in the Wombe although the Orifice of the Wombe open euen to an Abortment. And although the second Conception happen the third or the fourth month, yet it is not necessarie that the first should miscarrie; and yet the second Conceptions doe seldome thriue and suruiue, especially if they be long after the first, because the former Infant being great draweth away most part of the Blood, whence it commeth to passe that the younger Brother is defrauded of his nourishment, and so perisheth and is most what auoyded before his due time. And so much of *Superfetation*. Now it is time that we proceed vnto the Controuersies concerning the nourishment and augmentation of the Infant.

QUEST. XXIII.

Whether the Infant draw his nourishment at his Mouth.

OV R whole Disputation concerning the nourishment of the Infant we will absolute in three Questions. In the first we will dispute by what wayes he draweth his Aliment. In the second, what kind of nourishment he draweth. In the third, how that nourishment is changed and whether it passe all three concoctions.

For the first, *Alcmaeon* thought that the Infant drew his nourishment by his whole Body, because it is rare and spongy; and as a Sponge sucketh vp Water on euerie side, so thought he the Infant sucketh Blood not only from his Mothers veines, but also from the substance of her Wombe. *Democritus* and *Epicurus* thought, as *Plutarke* reporteth in his fifth Booke *De Placitis Philosophorum*, that the Infant in the wombe drew his nourishment at his mouth, which thing also Hippocrates seemeth to confesse in his Booke *De Principijs*: *The Child in the Wombe gathering his lips together, sucketh out of his Mothers Wombe and draweth both Aliment and Spirit to his Heart when the Mother breatheth.*

The manner of Superfetation out of Hippocrates.

Whether Superfetation may be after two or three months.

Answer.

Histories

Terpida

Hippocrates authoritie.

Second conceptions rarely thriue.

Which way the Infant drawes nourishment.

Alcmaeon opinion

Democritus and Epicurus

Hippocrates corrupted.

Hippocrates
excused,

His owne
opinion
in many places

This opinion he confirmeth with a double reason. First, because Children when they are borne haue Excrements in their Guts. Secondly, because as soone as they are borne they sucke Milke with their Mouthes, because they were accustomed to sucke in the womb. *Hippocrates* verily was so diuine a writer, that in all that he saith we are bound to reuerence him and giue good heed vnto him. And therefore herein we are either to excuse him, because in those times the skill of Anatomy was but in the infancie; or else we may thinke that this, as many other things, was foysted into his worke. For, in his golden Booke *De Nutritione*, he maketh knowne vnto vs the wayes of this nourishment of the Infant in this Oracle: *The first Aliment is through the Abdomen by the Nauell*. As if he should say: the first Aliment is drawne by the Nauell, because it is scituated in the midst of the *Abdomen*. For how should he draw it by his Mouth seeing there are no Vessels deriued thither? Neither hath the Infant any coniunction with the Wombe of the Mother vnlesse it be by the mouthes of their Vessels meeting together, all which Vessels do determine into the Nauell. Moreouer in his Booke *De Natura Pueri* he writeth in plaine words, that the Infant draweth both his nourishment and his spirit or breath by the Nauell. *In the middle of the Flesh is the Nauell separated, by which the Infant breatheth and getteth his encrease*. And in his Booke *De Oetimestri Partu*, *The Nauell by which the way is for the Aire and the Aliment to sustaine the Infant, and the onely ingresse by which he cleaueth to his Mother. And by this way is the Infant made partaker of those things that enter into the Body*. And againe in his Booke *De Natura Pueri*, *The Midwife as soone as the Infant is borne tyeth his Nauell, as being no more necessarie to nourish him by; and withall she openeth his Mouth to shew him another way by which he should receiue his nourishment*.

Why the In-
fant sucketh as
soone as he is
borne,

Scaliger.

What it is the
Infant auoy-
deth downe-
ward.

Seeing therefore *Hippocrates* in all these places teacheth vs that the Infant draweth his nourishment and aire also by the Nauell not by the Mouth; we conclude that the place about vrged is surreptitious. For the reasons which he is made in that place to giue are not befeeming the learning of so great a Man, neither answerable as you see to his opinion in other Tractates which are legitimate and past exception, as which indeed none but the diuine wit of *Hippocrates* could endite. Neither therefore doth the Infant sucke Milke after he is borne because he was accustomed to sucke in the Wombe, but because he is so taught by vntaught Nature. The same hath *Hippocrates* in the sixth Booke of his *Epidemia: Nature not taught doth yet that rightly which she hath not learned*. And in his Booke *De Nutritione*, *Nature is taught of none*. The Infant therefore instantly sucketh, not from Custome but by Nature or by Will, which is by Instinct: for after he is growne old he will sucke againe if he thinke it fit so to doe: because, as that most subtle *Scaliger* saith in his 239 Exercise: *There is but one Facultie which serueth the Soule for the behoofe of the Body, which also hath therewithall adioyned a notion of his owne conseruation*.

As for those Excrements which the Infant auoydeth by sledge as soone as it is borne, they are not Excrements of the first Concoction or of Chylification, and therefore cannot properly be called *Feces* and *Stercora*; but Recrements of the more impure and thicker Blood, which are conuaid by the Spleenicke and Mesenteriall branches from the Spleene to the Guts, and there by long stay and heat doe grow dry and exiccated. Wherefore we conclude that the Infant draweth not his nourishment by his Mouth but by the Nauell.

QUEST. XXIIII.

Whether the Infant be nourished onely by Blood, and whether he accomplish onely one Concoction.

That the In-
fant is nou-
rished with
pure Blood.



Concerning the nature and kind of Aliment wherewith the tender *Embryo* is nourished so long as he is contained within the Mothers Wombe, there is no light Controuersie. *Hippocrates* thought that he was nourished with the purest part of his Mothers Blood. To this purpose there is an elegant place in his first Booke *De Morbis Mulierum*. *A woman with child* (saith he) *is all ouer of a greenish pallid colour, because her pure Blood is daily drawne from her, and descendeth to the nourishment of the Infant*. *Galen* in his first Booke *De Causis Symptomatum* and the seuenth Chapter saith, *That the small and tender Infant drawes in the first monthes the purest of the Blood, but when he is growne greater, he draweth the pure and impure together*.

Hippocrates in his Booke *De Natura Pueri*, wrot many things but verie obscurely, concerning

ning the Aliment of the Infant: for he acknowledgeth a double Aliment, Blood and Milke. In the first months he thinkes the Infant is nourished with pure Blood: but *when he beginneth to moue, that then a part of the Blood returneth to the Paps, and is there turned into Milke, and from thence commeth againe to the Wombe by the communion of the Veines for the nourishment of the Infant*; as if the Blood were circularly conuaid from and to the Wombe againe as Chymists vse to doe in their Distillations. But I see not either why or how the Infant should be nourished with Milke, seeing all his Aliment is carryed first by the Veines vnto the Liuer: Vnlesse we shall say that the Infant growne great is nourished with Milke, that is, with Blood contained in the Veines of the Paps, which commeth neere to the nature of Milke. For when the Blood is exhasted or drawne out of the first Veines, he draweth Blood from other Veines, especially from such as are more common and ample or large. Now the societie of the Veines of the Wombe and the Paps is admirable. Here some Man may aske how the Infant can draw pure Blood seeing it hath much Whey mingled therewith, which is proued by the collection of the Vrine? I answer, that the naturall Whey doth not take away the puritie of the Blood, yea if it wanted his Whey it were not pure but altogether faultie: and Hippocrates alwayes disalloweth of that Blood which is *exempt*, that is, sincere and vnmixt.

Whether the Infant in the wombe be nourished with milke

Hippocrates expounded.

Obiection.

Solution.

The third thing to be enquired of remaineth, that is, how the Aliment of the Infant is changed and altered, whether it passe through the three concoctions, or but two, or onely one? Some imagine that the Blood is conuaid by the Vmbilicall Veine to the branches of the Gate Veine, from these vnto the Stomacke where it is conuerted into a substance like vnto Creame, and thence by the branches of the Mesenterie transported to the Liuer, and by it turned into Blood, and so is made by Chylification and Sanguification in the Infant. For Blood if it be taken at the Mouth and swallowed into the Stomacke, putteth off his forme of Blood, and acquireth a new forme of Creame. For my selfe if I may speake as I thinke, I conceiue that there is but one concoction in the Infant; for what need is there of Chylification or of a new Sanguification, seeing he draweth the purest of his Mothers Blood? I confesse that it is perfected and further boyled as well in the greater as in the lesser Vessels, that so there may be the greater similitude betweene the Infant and his nourishment; but that it should acquire a new forme, that will not sinke into my mind; for the Blood remaineth Blood and hath the same power of nourishing it had before, onely it differeth in perfection and in some accidents.

How many concoctions are in the Infant.

As for Chylification that was not necessarie in the Infant, because the Excrement of Chylification which is thicke and fœculent or euill sauoured would with the weight and burthen be troublesome to him, seeing he hath no Membranes allotted for the receiuing or containing them. Hereto you may also add the noysome smell of the Excrements, which doubtlesse would be offensive both to the Infant and to his Mother. We conclude therefore that in the Infant there is no other but onely the third concoction.

That there is onely the third concoction.

QUEST. XXV.

Of the communion of the foure Vessels of the Heart in the Infant.

The first Exercise.

Wherein the truth of Galens demonstration is illustrated.



HAT wonderfull communion of the Vessels of the Heart which is found in the Infant, to wit, of the hollow Veine with the Venall Arterie, and of the great Arterie with the Arteriall Veine, Galen first of all Men hath so excellently described in his sixth and fifteenth Bookes of the Vse of Parts, that there is nothing in that whole Worke more plainly, more clearely, nor more diuinely handled: But in the vse of these Anastomoses he hath not so sufficiently playned himselfe. For in the fifteenth Booke he thinketh that both those Inoculations were framed only for the Lungs sake; but in the sixth Booke he writeth that they are some helpe vnto the Heart for the performance of the offices of the Vitall Facultie. Wherefore because in diuers places he speaketh of diuers vses of them, although both places may well stand together, yet thence haue

Galen first described this communion.

But varieth in the vses thereof.

haue all those taken occasion to carpe at him, who either from a spirit of contradiction, or from an ambitious desire to gain-say great Men, or from a kind of wantonnesse of wit doe forsake the authenticke learning of the Auncients and seeke for a new kind of Philosophy in the Greene, raw and vnripe fruits of the later Writers.

How farre we
are to stick
to the ancients

It is not good indeed to pin a Mans knowledge vpon any particular Mans sleeue, neither doe I thinke it the part of a true Philosopher to swear that another Man hath said, were it *Hippocrates* himselfe: but yet wherein the Ancients haue gone before vs in strength of demonstration and euidence of truth, there to start aside after the nouell and vndigested inuentions of Greene wits, I hold it may be a signe of a ripe wit, but not of sound and established wisdome or iudgement. Wherefore I will endeavour in this place to shew you *Galen's* curious, elegant and accurate demonstration of the communion of these Vessels; afterward we will enquire also what other Men haue said of it.

Galen's elegant
demonstra-
tion of this
communion.

Galen therefore in his fifteenth Booke *De Vsu Partium* and the sixth Chapter, asketh the question, why the Lungs in the Infant are red and not whitish as they are after a Man is borne. He answereth, because they are nourished with thicke and red Blood brought vnto them by Vessels hauing but a single Coat, that is, by Veines. But there are no passages from the hollow Veine into the Lungs; and therefore it was of necessitie that that hollow Veine should haue a passage bored into the Venall Arterie. This therefore is the first and primarie vse of this hole or perforation.

Illustrated.

The vse of the other coniunction which is betweene the great Arterie and the Arteriall Veine by a Canale or Pipe running betweene them, he thinketh ought to be referred to the maintenance of the life of the Lungs. For all life is from the Vitall Spirit and the Arteriall Blood, that is deriued by the Riuerets of the Arterie; which because they no way pertaine or reach vnto the Lungs, it was of necessity that the great Arterie should be vnited to the Arteriall Veine. This is *Galen's* demonstration which haply will seeme to many obscure, but I will make it brighter then the mid-day Sunne.

The Lungs in the Infant are red, much like the Flesh or *Parenchyma* of the Liuer, and thicker beside then they are after a Man is borne; red they are, because they are both generated and nourished by red Blood; thicker, because they are neither attenuated by inspired aire, nor yet moued perpetually as they are after the birth. For we doe not thinke that the Chest of the Infant is moued in the Wombe; if the Chest be not moued then it is not likely that the Lungs are distended or contracted, because the Lungs are not moued by any proper or in-bred facultie of their owne, nor by the pulsatiue facultie of the Heart, nor by the Braine; but onely they follow the motion of the Chest to auoid vacuitie, as we shall hereafter more cleerely proue when we come in the next Booke vnto the Historie of the Chest. But when the Infant is borne the Lungs become suddenly more rare & spongy, and whiter by much because they are attenuated by perpetuall motion and by the permixtion of aire breathed into them.

Wherefore the substance of the Lungs is not the same in the Infant when he lyeth darkling in the corners of the Wombe and when he enioyeth the vse of the worlds light. If the substance be not the same, neither is it proportionable that the Aliment should be the same. The Lungs being rare and spongy stand in need of thin Blood laboured in the hot and boyling right Ventricle of the Heart, and therefore *Galen* thought that the right Ventricle was onely made for the vse of the Lungs. And as *Aristotle* first obserued those Creatures which haue no Lungs doe also want the right Ventricle of the Heart.

Now the thicke, red and immouable Lungs of the *Embryo* doe not need Blood attenuated, but are contented with that which is thicke and like themselves. This crasse and red Blood is onely conuained in the branches of the hollow Veine. But how should it attaine out of these branches of the hollow Veine vnto the Lungs, seeing there are no branches from that hollow Veine disperfed into the Lungs? for the Lungs haue only three Vessels. The Venall Arterie, the Arteriall Veine and the Rough Arterie. Here therefore Nature with wonderfull Prouidence & Art, perforated the Venall Arterie which adioyneth vpon the hollow Veine, therein to inoculate the Veine, that so the Blood might haue a free passage for the nourishment and encreasing of so fleshy a Bowell as the Lungs are; so that in the Infant the Venall Arterie performeth onely the office of a Veine, and may absolutely then be called a Veine as well for his vse as for his structure. This therefore is the true vse of that open hole, this the necessitie of that famous inoculation.

Anciens opini-
on of the vse
of this com-
munion.

Ancien the Prince of the *Arabians* hath confirmed this demonstration of *Galen*. The Lungs
(saith

(saith he) are red in the tender Infant, because he draweth no aire into them, for they grow not white but onely by the permixtion of breathed aire. They are therefore nourished with red Blood, and to that end is the hole made out of one Vessell into another, which is presently stopped after the Infant is borne.

Neither yet is this Inoculation made onely for the nourishment of the Lungs, but also for the first generation of their *Parenchyma* or Substance. For it is out of doubt that the Flesh of all the Bowels is made of the Blood congealed or clodded together. This Blood is onely brought by Veines, but there were no passages from the hollow Veine to the Lungs, and therefore there was bored an open and patent hole out of the hollow Veine into the Venall Arterie.

Second use
of it.

I will add a third use of this communion, that that Venall Arterie might be formed out of the hollow Veine. For a thin and Venall Vessell could not arise out of the thicke and crasse left Ventricle of the Heart: Now it was necessarie both that this Vessell should be fixed into the left Ventricle of the Heart and also be thin, that when we draw in our breath it might suddainly receiue the aire, and when we expire it might expell fumid and sootie vapors. It was necessarie therefore, that the hollow Veine should be vnited with the Venall Arterie; so that the Venall Arterie may seeme to be a production of the hollow Veine; and his first originall is not from the Heart as is commonly imagined, but from the Liuer by the continuation of the hollow Veine.

A third.

The use of the other communion which is betweene the great Arterie and the Arteriall Veine by the interposition of a Canale or Pipe, I thus manifest. The Lungs doe liue in the *Embryo*, therefore they stood in need of Vitall Spirits and Arteriall Blood for their conseruation. These Vitall Spirits and Blood are onely contained in the branches of the great Arterie; from this great Arterie into the Lungs there was at all no passage. Nature therefore (least the Lungs should be defrauded of that quickning *Nectar*) made an Arteriall pipe perforated from the great Arterie into the Arteriall Veine, by which a part of the Arteriall Blood and Vitall Spirits might be conuained vnto the substance of the Lungs.

These of the
other commu-
nion by the
Canale.

I acknowledge also another use of this second communion; that this Arteriall Veine might take his originall from the *Aorta* or great Arterie. For the Veine of the right side of the Heart stood in need to be Arteriall, that is, to haue a thicke Coat like that of the Arteries. Now the Fountaine of the Arteries was in the left Ventricle. Wherefore Nature propagated the great Arterie, and made out of it an Arteriall production or pipe which reacheth into the right Ventricle, there to forme the Arteriall Veine; so that hence it is euident that the Arteriall Veine is a production of the great Arterie, and the Venall Arterie a production of the hollow Veine. So it is therefore with the Vessels of the Lungs in an Infant yet contained in the Wombe, that the Venall Arterie performeth the office of a Veine, the Arteriall Veine of an Arterie, but the Rough Arterie is altogether idle. And this is the true demonstration of these two Vnions or Communions of the Vessels of the Heart in the Infant yet vnborne.

Another use
of it.

The use of the
Vessels of the
Lungs in the
Infant

The second Exercise.

Wherein the new demonstration of the use of these Communions divulged by
Simon Petreus a Physitian of Paris is confuted.

BUT that the truth of this demonstration of *Galen* may be more apparent, let vs a little examine some opinions of the late Writers concerning the use of the Inoculations. *Petreus* is of opinion, that they were ordained rather for the use of the Heart and the whole Body, then for the nourishment and life of the Lungs. And this is the summe of his demonstration, and these for the most part his owne words.

The first intent of Nature is to make all things perfect, but the absolute perfection of her worke she doth not alwayes attaine by reason of the crosse or auerse disposition of the subiect matter, which *Aristotle* calleth the Hypotheticall or materiall necessitie. But what Necessitie constrained Nature to produce these Inoculations of the Vessels? Surely the Necessitie was verie great, which if a Man be ignorant of, he shall neuer vnderstand their Historie. The Use and the Action is the end of Nature when she worketh, and the scope or ayme of the Physitian who searcheth into the workes of Nature, which scope if he neglect

Petreus opin-
ion and de-
monstration.

neglect all Anatomie will be vncertaine, and all his inspection of the part will but double their obscuritie.

Aristotle often admonisheth, that the Organs are made for the Vse, not the Vse applyed to the Instruments; whence it is that *Galen* first propoundeth the Vse and thereto recalleth the Composition and Conformation of euerie part: I will therefore first shew the Vse and necessitie of these Inoculations of the Vessels of the Heart.

The Vmbilicall Arteries doe transmit from the Mother to the Infant Arteriall and Vitall Blood, for they are inserted into his Iliacall Arteries. From these the Blood ascendeth into the trunk of the great Arterie, yea euen to his gate in the Basis of the Heart, where it is constrained to make stay, because Nature hath set at that gate of the great Arterie three Values whereby the passage is bolted from without inward, albeit from within outward any thing may passe. For this inconueniencie & obstacle Nature deuised a present remedy. For considering that the Blood laboured in the left side of the Mothers Heart, and further prepared in the length of his way from the Mother vnto the Infant, was fit for the nourishment of his Lungs; she provided that it should be poured into the Arteriall Veine which is destined for the nourishment of the Lungs. And for that purpose she prepared in the Infant a passage common to the great Arterie and the Arteriall Veine which is conspicuous aboue the Basis of the Heart which we call *Anastomosis*. For the other *Anastomosis* I thus demonstrate the vse thereof.

We before determined that the Arterial Blood which the Infant receiueh from his Mother by the Vmbilicall Arteries, is spent in the nourishment of the Lungs. Now it will be worth our labour to learne how Vitall Blood sufficient to be diffused thorow-out the whole Body is in the Infant generated; for there is no aire led by the Venall Arterie into the left Ventricle of the Heart whereof the Spirits should be made, because the Infant breatheth not in the Wombe, neither getteth any thing into the Heart by the great Arterie, for the Values which open outward and shut inward will admit nothing to enter. The left Ventricle therefore of the Heart had beene vnprofitable through want of matter and the discommoditie of the place, vnlesse Nature had learned of her selfe to frame wayes for her owne behoofe more easie and expedite, which is the other *Anastomosis*, wherein she hath wrought a worke beyond all admiration.

This *Anastomosis* is out of the hollow Veine into the Venall Arterie, by which the Blood (which is too much for the nourishment of the Lungs) is commodiously transported into the left Ventricle of the Heart, where it is laboured, conected and receiueh an impression of the Vitall Facultie, and so turneth aside into the great Arterie which is neere neighbour and toucheth it, that by it it might be distributed into the whole Body.

This demonstration I take to be most true, that the worke of this *Anastomosis* which is a verie miracle in Nature might rather be referred to the vse of the whole Body then vnto an vnprofitable commoditie onely of the Lungs. Neither doe I see by what reason it may be said that the Lungs of the Infant which doe not moue at all whilst it is in the Wombe, should yet then require and dispend a greater quantitie of Aliment and Blood then they doe after the Child is borne, when for the generall behoofe of the Body they are perpetually moued. For if those Inoculations had beene made onely for the Lungs, they being greedy would haue drawne all the Blood by those patent passages which in growne Men they draw onely out of the Arteriall Veine. Furthermore, this absurditie would follow, that the Vitall Facultie of the Heart in the Infant must be idle all the time of his gestation.

This is *Petrus* his demonstration, wherein that I may speake in one word, he establisheth two things: The first that the Arteriall canale or pipe was made for this purpose to poure out into the Lungs alone the Arteriall and Vitall Blood which the Infant draweth by the Vmbilicall Arteries; so that he vnderstandeth that the Vmbilicall Arteries were not made for the vse of the whole Body but onely of the Lungs.

The second thing he would establish is, that the Lungs are not nourished by the Blood brought thorow the hole of the hollow Veine into the Venall Arterie, but that all that Blood is transmitted into the left Ventricle of the Heart for the generation of the Vitall Spirits.

Which two things how absurd they are and dissonant from true and right reason, I will endeavour to shew both by Reason and Sence, which are the two most certaine Iudges of all things.

The summe of
Petrus opini-
on.

Petrus
impugned

In his vse of that communion which is by an Arteriall Canale or Pipe from the great Arterie into the Arteriall Veine; I find some things contradictorie, and verie many false and absurd.

For sometimes he wils, that both the inoculations were made for the vse of the whole Body, not for the commoditie onely of the Lungs; afterward as if he had forgotten himselfe, he writeth in his whole discourse that that Canale which is from the great Arterie to the Arteriall Veine serueth onely for the Lungs: Whereas to make good his demonstration, he should haue said that the inoculation which is from the hollow Veine to the Veball Arterie is to be referred to the vse of the whole Body; but that which is from the great Arterie into the Arteriall Veine, onely to the nourishment of the Lungs. There is therefore in the first place a manifest contradiction; I forbear to say how improperly he calleth the Arteriall Pipe an *Anastomosis*: because I am taught by *Aristotle* not to take too much care of words or to stand too much vpon them.

Galen indeed faith that there are many *Anastomoses* or inoculations of Veines and Arteries, and that an *Anastomosis* is nothing else but an opening of the mouth of one Veine or Vessell into another, and those Medicaments are called *Anastomotica* which haue a facultie to open. We also may vnderstand by *Anastomosis* the confluence of humors made when the Vessels doe open one into another. *Aristotle* in his Booke *De Mundo* (if that Booke were *Aristotles*) vseth the word in another sence, when he calleth the Ocean *ἀνέσσυμος*, which *Budeus* interpreteth in *fauces se comprimitem*: but to call a Pipe, a Tunnell, a Vessell an *Anastomosis*, is a monster in Grammer, in Philosophy and in Physicke. Now *Petrus* words are these: *And for that purpose Nature prepared in the Infant a passage common to the great Arterie and the Arteriall Veine, which is conspicuous about the basis of his Heart which we call Anastomosis.* Let any Man now iudge, yea let himselfe see how farre this nouell speculation of his hath transported him: but this is but to play with him, let vs now set vpon him with keener weapons. He writeth that the Arteriall Blood which the Infant draweth by the Vmbilicall Arteries, is wholly consumed in the nourishment of the Lungs, and that those notable Arteries were onely made for their vse: then which what could he haue said or fained more absurd?

Let him turne ouer all the writings of the *Grecians*, the *Arabians* and the *Latines*, and he shall see that they all accord in this, that the Vmbilicall Arteries were made for the vse of the whole Body not of the Lungs alone. By these Arteries the whole *Embryo* doth transpire and draweth the Mothers spirit, not the Lungs alone. The vse therefore of the Arteries is common to the whole Body of the Infant. And this *Hippocrates* teacheth in his Bookes *De Natura Pueri*, and *De Octimesfri Partu*, in these words: *In the middle of the Flesh is the Nauell separated, by which the whole Infant doth transpire and attaineth his encrease.* Doe not the Arteries in their Diastole or dilatation draw aire, and expell the footie vapors in their Systole or contraction? There are made many inoculations from the Arteries into the Veines, therefore the aire is transported out of the Arteries into the Veines, not out of the Veines into the Arteries.

Galen in his fourth and sixth Bookes *De Locis Affectis*, in his Booke *De Vsu Pulsuum*, in his Commentarie vpon the sixth Section of the Booke *Epidemia*, teacheth vs that transpiration is through the Arteries not through the Veines; and in his first Booke *De Semine*, he saith: *The hole or passage of the Membranes about the Nauell is alwaies open for the transmission of Blood and Spirits, for Blood floweth out of the Veines, but out of the Arteries Spirits with a little thin and hot Blood.* What could he say more plainly, what more perspicuously? This also auoucheth *Auicenna* the Prince of the *Arabians*, and finally it is the vniforme consent of the Schoole of the *Grecians* and *Arabians*: And with vs this common consent of so learned Men shall euer stand for a Law. But *Petrus* one Man, of his owne head taxeth and challengeth all antiquitie of Error. Well, we will therefore no more contend with him with authorities, but by weight of argument.

It is an Axiome in *Aristotle*, that all liuing Creatures doe breathe. For as a Flame pent vp in a strait room and not ventilated or breathed with Aire groweth dimme & at length is extinguished: so our naturall heat is also extinguished vnlesse it be ventilated and waisted with Aire as it were with a fan. This spiration which the *Grecians* call *πνιξ* or *πνικα* is double; the one insensible called *σπνικον*, or *Transpiration*, which is made by the Arteries and other blind breathing holes of the Body; the other may be seene with the Eyes, and is made by conspicuous passages, as the Mouth & the Nofethrils which *Galen* calleth *ἀναπνοή*, *Respiration*.

That

A contradiction in his demonstration.

He vses the word *Anastomosis* verie improperly.

He thinketh amisse that the Vmbilicall Arteries serue onely for the Lungs.

Spiration double. Transpiration & respiration.

The Infant
doth not
respire.

That the Infant in the wombe doth not *Respire* it is most manifest, because he neither ought nor can, as we shall proue in our next Question. It is necessarie therefore that he must haue *Transpiration*, which is not by the Vmbilicall Veine, nor by the *Vrachus*, and therefore by the two Vmbilicall Arteries; for there are no more but these foure Vessels in the Nauell. Wherefore this vse of the Vmbilicall Arteries is common to the whole Infant not proper onely to his Lungs.

That all the
Arterial blood
is not spent in
the nourish-
ment of the
Lungs.

That all the
Arterial blood
is not spent in
the nourish-
ment of the
Lungs.

Now that in the Arteries not onely Aire as *Erasistratus* thought, but also a Vitall Spirit and Arteriall Blood is contained, we are taught by *Experiment* or *Inspection*. The Arteriall Blood then which the Infant draweth by the Vmbilicall Arteries is it not prepared for the life of the whole *Embryo* and the conseruation of the naturall heat? Doth the red and thick *Parenchyma* of the Lungs, not at all as yet moued, stand in need of so great a quantitie of thin and Arteriall Blood? If one Veine which they call the *Nurse of the Embryo*, sufficeth for the nourishment of the whole Infant, why should not one small Arterie haue beene sufficient for the nourishing & cherishing of the Lungs, which are a little part of the Infant? But Nature made two Vmbilicall Arteries and those notable ones, which are branched through the *Chorion* with infinite furcles.

Moreover, if all that Blood which the Infant draweth by the Vmbilicall Arteries were consumed in the nourishing of the Lungs, then these absurdities would follow. First, that the Lungs are not nourished with Blood like vnto their substance, nor with pure Blood. For the Vmbilicall Arteries do returne the Blood into the *iliacke* branches, and from them into the trunk of the *Aorta* or great Arterie; wherefore the Arteriall Blood of the Mother shall be mingled with the Arteriall Blood of the Infant, which he saith is generated in the left Ventricle of the Heart, and thence diffused into the pipes of the great Arterie: and so it will come to passe that one of them shall offend another; for in the same Vessell there shall be at one and the same time perpetually two contrarie motions: one of the Blood ascending from the *iliacke* branches to the Lungs; and another of the Arteriall Blood descending from the left Ventricle of the Heart to the same *iliacke* branches: which thing albeit we confesse, it sometimes hapneth in Criticall euacuations and notable endeauours of Nature: so, that it should be perpetuall we cannot be perswaded. Let vs then wipe away this mist from our Eyes, and let vs beleue that the two Vmbilicall Arteries were made for the vse not of the Lungs alone but also for the whole Body. Now let vs come vnto the vse of the other Inoculation.

His vse of the
other inocula-
tion impugned

Petrens conceit is, that the hollow Veine is perforated into the Venall Arterie, that the Blood might be poured into the left Ventricle of the Heart for the generation of Vitall Spirits, neither doth he acknowledge any other vse thereof. But we with *Galen* thinke that it was formed for the generation and nourishment of the Lungs. For if there be a new generation of Vitall Spirits in the left Ventricle of the Heart, made of the Blood which is conuayed in the hollow Veine as *Petrens* would haue it; then what need was there of that hole or perforation? Doth not the hollow Veine gape into the Heart with a wide mouth to poure abundance of Blood into his right Ventricle? Why is not the Blood there boyled and attenuated, and after sweateth through the partition into the left Ventricle, and there receiue the stampe or impression of the Vitall Spirit? The Blood so attenuated in the right Ventricle would be purer and more defacated, then if it should be transfused out of the hollow Veine into the left Ventricle by that *Anastomosis*; there would haue therefore been no necessitie of Vitall Spirits, but for the nourishment of the Lungs there is absolute necessitie thereof.

2. Reason.

Againe, it is an Axiome in Physicke and Philosophy which *Galen* often beateth vpon, that there is neuer made any perfect elaboration vnlesse a preparation goe before. So the Animall Spirits are prepared in the webbes of the Braine; the Seed is delineated in the writhen complications of the Seed Vessels; the Blood attaineth a rudiment in the Veines of the Mesenterie; and the preparation to the third concoction is made in the small Veines of each particle. But if according to *Petrens* Hypothesis the Blood should be transfused from the hollow Veine into the Venall Arterie which toucheth it, and from that into the left Ventricle of the Heart, where I pray you shall that Blood be prepared or attenuated? If that new conceit of the Generation of Vitall Spirits in the Infant were to be admitted at all, it were more probable to say, that the Blood were poured out of the hollow Veine into the right Ventricle and there prepared, because the Membranes doe not hinder the ingate hereof, and beside the partition is bored with so many passages to conuey it into the left.

left. For it is the opinion of all learned Men, that the right Ventricle was ordained for the preparation of the Vitall Spirits.

Moreover, it is most certaine that there is a double matter of the Vitall Spirit, Aire and Blood. Now *Petrens* doth not thinke that Aire is carryed into the Heart, for the Infant in the Wombe doth not Respire, how then shall that Vitall Spirit be generated & preserued? Out of doubt it will decay and be extinguished being defrauded of conuenient Aliment. *Hippocrates* in his Booke *De Natura Pueri* saith: *Euerie thing that is hot is nourished with that which is moderately cold.* Indeed Transpiration is sufficient to preserue a little heat; but for the perpetuall generation of Vitall Spirits in bloody Creatures there is required great abundance of Aire, which onely can be supplied by Respiration. But let vs pursue these Detractions a little farther.

If we shall admit this new and onely vse of the hole or inoculation, that is, that all the Blood should be conuained from the hollow Veine through the Venall Arterie into the left Ventricle of the Heart, with what Blood shall then the Lungs be nourished? Open the wayes: Shew me the Veine of the Lungs. For now all the Venall Arterie is taken vp, forsooth, to lead Blood vnto the Heart, and the Arteriall Veine only leadeth Vitall Spirits and Arteriall Blood which it receiue from the great Arterie by the Canale or Arteriall Pipe. Shall the Lungs be without Aliment? He will answer, That it is nourished with Arteriall Blood which commeth from the Mother, and that for that purpose the two Vmbilicall Arteries were ordained. But hath he forgotten that all parts want two sorts of Blood, one Venall, another Arteriall? The Venall Blood by true assimilation turneth into the substance of the part, the Arteriall is appointed to conserue, refresh and cherish the naturall heat of the particular parts which is but fugitiue.

I will not deny but some part of the Mothers Arteriall Blood is conuained into the Lungs by the Arteriall Pipe to preserue their life and to defend their naturall heat, but that the Lungs are therewith nourished, I altogether deny. For the Lungs of the *Embryo* are thicker, faster & heauier then they are after the birth, and therefore must be nourished with thicker Blood, for it is a constant truth, that we are nourished with that which is like vnto vs; euen euerie particular part is nourished with that which is most like vnto it.

This Law and Constitution of Nature, *Petrens* by this new Demonstration doth quite abrogate and annihilate, because he appointeth thinner Blood for the Lungs of the Infant which are red, heavy, sad & thicke, then for the Mothers which he must confesse are whiter and thinner. For the Mothers Lungs are nourished with Blood attenuated in the right Ventricle of the Heart, and deriued vnto them by the Arteriall Veine: He stily maintaines that the Lungs of the *Embryo* are nourished with no other then Arteriall Blood laboured and heated in the left Ventricle of the Mothers Heart, & brought vnto them by the Vmbilicall Arteries, forsooth, to make recompence for their want of motion. Here also we haue a manifest contradiction. He confesseth that the Lungs are thinner after birth, thicker in the *Embryo*, and yet he saith that the first are nourished with thicker Blood, the latter with pure Arteriall Blood full of Spirits.

And whereas he buildeth vpon *Galen*s foundations that the Lungs are made of the froth of the Blood, and therefore doe require for their nourishment thin and Arteriall Blood. He seeth not that that place is to be vnderstood of the Lungs after the birth; for in the Infant the Lungs are not frothy nor whitish, but red, heavy and thight, yea euen a while after the birth doe the Lungs remaine heavy and red; whence it commeth to passe that many Infants shortly after their birth are strangled, because the Lungs cannot play themselves, either when the Child lyeth vpon his Backe, or by some compression of his Chest; and therefore it is best to lay Children with their Heads somewhat eleuated or rayled vp, that the Lungs which are heavy may more easily follow the contraction and distention of the Chest.

Those Children which dye so suffocated if they be opened will be found to haue their Lungs full of thicke Blood, and verie red. But let vs heare *Galen* accurately describing the Lungs of a tender Infant in the sixth Chapter of the fifteenth Booke *De Vsu Partium*, in which place he of set purpose expresseth the Historie of the Infant: *Why are the Lungs of an Infant red and not whitish as after birth? Because they are nourished with Blood brought vnto them by Vessels which haue but a single Coat.* And then he addeth: *When the Creature beginneth to respire the Lungs are moued perpetually; whence it is that the Blood being diuided by the double motion of the breath is made thinner then before, and as it were frothy, and so the Flesh of the Lungs*

3 Reason.

4 Reason.

He abrogates
the Lawes of
Nature.Another con-
tradiction in
Petrens de-
monstration.*Galen* expound-
ed.How children
are often
strangled.How to
remedy it.A pregnant
place in *Galen*
against *Petrens*.

Arguments
from *anastomosis*.

which before was red, heavy and thight, becommeth white, light and rare or spongy. How pregnant and plaine a place this is, who seeth not? The Flesh of the Lungs of the Infant is red, heavy and fast, and afterward becommeth thinner and frothy: wherefore the Lungs of the *Embryo* stood in need of red and thicke Blood, which kind is onely conuayed by the Rillets of the hollow Veine, not through the thicke Pipes of the great Arterie. But there are no passages from the hollow Veine to the Lungs, and therefore Nature made that admirable *Anastomosis* for the nourishment of the Lungs. And thus *Petrus* ought to haue playd the Philosopher, and not to haue abused that which *Galen* intendeth concerning the nourishment of the Lungs after birth, to the nourishment of the Lungs of the *Embryo*, in the Mothers Wombe. But if he will not yeeld to these Reasons which are cleere demonstrations, then we cite him to the Tribunall of Truth to *avrofiav*, that is, to ocular inspection. Cut the Lungs of the *Embryo* and you shall see all the branches of the Venall Arterie full of red and thicke Blood. From whence, good *Petrus*, is that Blood? Is it not from that hole of the hollow Veine?

We conclude therefore, that that admirable *Anastomosis* or Inoculation was framed by Nature, not for the elaboration of the Vitall Spirit, but for the generation, nourishment and increment of the Lungs. Thus much we thinke our selues bound to haue said, not onely to redeeme the credite of our Master *Galen*, but especially to vindicate and redeeme the truth, albeit it be with the losse of a learned Man, such as we willingly acknowledge *Petrus* to be; but he must be content to suffer himselfe to be gain-sayed if he gain-say the truth; and if any thing fall from vs in discourse which may sound somewhat more harsh in his Eares or those that follow him, that also must be attributed to the heat of disputation: For much may be forgiven a Souldier when he is heated in the medley, which might be imputed to him for crueltie in cold Blood.

The third Exercise.

Another new Demonstration of the use of the Inoculations, denised by Francis Rosset, a learned Physitian belonging to the French King.

Rosset's
opinion
of the use of
the Inocu-
lations.

Aurentius reports, that when Dr. Francis Rosset, the French Kings learned Physitian, heard of this difference of opinions betweene him and *Petrus* concerning the use of the Inoculations, he wrot vnto him that he had found out a new use of both these Communions of the Vessels of the Heart in the Infant, and that he sent also to him this Table which we haue annexed.

His opinion is, that both these Inoculations were ordained onely for the conuaince of Aire, directing it to the Lungs before it should come at the Heart, & mingling it with both kinds of Blood, Venall and Arteriall, prepared before in the Liuer and the Spleene: For as after birth the outward Aire is not carried crude & raw into the Heart, but passing through the Rough Arterie is prepared in the rare substance of the Lungs, and is made fit for the Heart: so in those that be not yet borne, the internall Aire must necessarily come to the Lungs for the same end where it vndergoeth a peculiar Castigation before it be admitted to the Heart. Moreouer, from the thinnesse of that Aire and the pulsatiue motion of the Heart, this commoditie the Lungs must needs haue, that their *Parenchyma* in the Infant and the Vessels therein, are accustomed and prepared to the motions of Expiration and Inspiration which are to follow after he is borne, for the Aire enlargeth the Pores in them, and so fitteth them for the use of the Child when he cryeth.

Wherefore the two Inoculations in the Infant vnborne, and the Rough Arterie after the birth, may be compared to *Caster* and *Pollux*, of which when one aryseth the other is destined to set.

In

IN THE INFANT,

To be borne,

Already borne.

Doe Worke.	Are Idle.	Doe Worke.	Are Idle.
1 The Chorion, the Stomacke being Idle.	1 The Stomacke, the Chorion working.	1 The Stomacke, the Chorion being Idle.	1 The Chorion, the Stomacke working.
2 The Vmbilicall Vessels, the Vessels of the Mesenterie being idle.	2 The Vessels of the Mesenterie, the Vessels of the Nauell working.	2 The Vessels of the Mesenterie, the Nauell Vessels being idle.	2 The Nauell Vessels, the Vessels of the Mesenterie working.
3 The Vrachus, the Vreters being Idle.	3 The Vreters, the Vrachus working.	3 The Vreters, the Vrachus being Idle.	3 The Vrachus, the Vreters working.
4 The Inoculations of the Heart, the Rough Arterie or Weazon being idle.	4 The Weazon or Rough Arterie, the Inoculations working.	4 The Rough Arterie, the Inoculations being Idle.	4 The Inoculations of the Heart, the Rough Arterie working.

The Exposition of the Table.

Euen as the operation at certaine times, and the rest at others, of the three first, to wit, the Chorion, the Nauell Vessels and the Vrachus is answerable to the other three set against them, to wit, the Stomacke, the Mesenterie Vessels and the Vreters, each one respecting his confort or substitute in the administration of one and the same thing necessarie to life: so likewise is there the same succession of operation and rest at different times betweene the foure paire of Conforts, to wit, the Inoculations of the Heart and the Rough Arterie or Weazon, in the administration of one and the same thing necessarie to life.

Rosser his demonstration.

For seeing there can be nothing found nor imagined in the whole Body, which in the Wombe, when the Rough Arterie is at rest, should supply his office which is necessarie to life, vnlesse it be the Inoculations of the Vessels of the Heart; which Inoculations in the Wombe doe worke but cease their labour when the Infant is borne, the Rough Arterie then vndertaking his incessant labour himselfe: it must needs follow that the vse of the Inoculations in the Wombe is the verie same that there is of the Rough Arterie after the Infant is borne. Now all Men acknowledge that the Rough Arterie is ordained for the transvection or transportation of the externall and ambient Aire to the Lungs of the Infant which prepare it, for the Heart standeth in need of Aire so altred. Wherefore the true vse and office of the Inoculations (which onely haue vse whilst the Infant is in the Wombe) is the transvection or transportation of Aire (but that internall comming out of the Mothers Wombe through the Chorion and the Vmbilicall Vessels) to the same Lungs of the Infant which are to prepare it for his Heart.

The last limit is the eleuenth month, the times betweene are the ninth and the tenth.

This is Rosser's opinion, wherein he laboureth to establish, that both the Anastomoses or Inoculations are appointed onely to lead Aire to the Lungs, and that by them the Infant doth respire and the Lungs are moued for the new generation of Vitall Spirits. But our opinion is, that the Infant doth not at all Respire but Transpire onely, as we shall shew in the next Question; neither yet doe we thinke that it was necessarie there should haue been made so notable Inoculations if onely the conueyance of Aire to the Lungs had been necessarie. For seeing in perfect Creatures and those that haue most vse and strength of voice, there is but one Weazon or Rough Arterie ordained, why should not one Inoculation haue serued in the Infant whilst yet he maketh no vse of his Lungs for voice? It had beene more probable if he had said, that one of the Inoculations was made to lead Aire the other to lead Blood. Moreouer, if onely Aire be lead by these Inoculations to the

The 11 the last.
Rosser's opinion disproued.

Vessels of the Lungs, why doth there appeare in the Venall Arterie so red Blood, and in the Arteriall Veine Arteriall Blood full of Spirits? With what Blood shall the red and thicke Lungs of the Infant be nourished? In a tender Infant that Transpiration which is made by the Arteries and other blind passages is sufficient for the conseruation and refection of his weake heat.

The conclusion.

We conclude therefore, that both the Inoculations were originally made to generate and nourish the Lungs, because whereas the Lungs of an Infant before birth doe differ from his Lungs after birth, in colour, thicknesse and fastnesse of Flesh, they needed also an other kind of Blood for their generation and nourishment before then they doe after. And thus we are come to an end of that admirable worke of Nature in the Inoculation of the Vessels of the Infants Heart.

QUEST. XXVI.

Whether the Infant in the wombe doe Respire and stand in need of the labour of his Lungs.

What Respiration is.



Concerning the nature of Respiration we shall haue a fitter place to dispute in the next Booke where we treat of the Lungs. In this place it shall be sufficient to giue you Galens description thereof in his Commentarie vpon the Booke *De Salubri Dieta*, where he saith: *Respiration is, when the breath is drawne in and let out by the Mouth.* So that in Respiration it is necessarie the Chest should be contracted and againe dilated, and the Lungs moued thereafter. If therefore I shall proue that in the Infant the Chest is not contracted or dilated, nor the Lungs moued, it will follow that he doth not Respire but Transpire onely.

That the Infant doth transpire onely and not respire in the Wombe.

The Vitall Facultie in bloody and hot Creatures stands in need of two things for the conseruation thereof: Respiration and Pulsation. But those Creatures which are without Blood and imperfect, which haue little heat, doe liue contented onely with the pulsation of the Arteries and Transpiration. So those we call *ivroua* and which liue in holes all Winter doe Transpire but Respire not. So likewise *Hysterical* Women, that is, such as are in fits of the Mother, the heat of whose Heart is languid and weake being dissolued by a venemous breath of corrupted Seed, doe liue a time without Respiration, and many haue been buried for dead when they were yet aliue.

The Infant neither ought, nor can respire

The Infant because he hath but a weake heat, and is in the Wombe before the day of his birth as it were an imperfect Creature, is contented onely with Transpiration, and therefore he draweth not his breath by his Mouth, neither vseth he the helpe of his Chest or Lungs. For Respiration is onely ordained for the behoofe of the Heart, that the spirituous substance which is wrought in the glowing hot left Ventricle might with the Aire be cooled as it were with a Fan, and beside purged and refreshed; but there is no generation of Vitall Spirits in the Infant, as by and by we shall demonstrate: and therefore there is no need of Respiration; for the finall cause sayling which moueth all the rest, Nature is too wise to vndertake any labour. The Infant therefore doth not Respire because he ought not. Add hereto that he neither can Respire: for being shut vp in his Mothers Wombe and compassed about with Membranes, if he should draw in breath at his Mouth with the aire he should also draw in the Water wherein he swimmeth, and at the first draught would be so suffocated as they that are drowned in a Riuer. Again, he hath no Aire that he might draw, for there is no space in the Wombe that he doth not fill, and beside the Orifice of the Wombe is so close locked vp that it will not admit a little wind to enter into it. Again, that no Aire is inspired by the Mouth or the Nofethrils, the substance and colour of the Lungs doe sufficiently declare. For all Creatures which draw Aire at their Mouthes and Noses haue white and thin Lungs, but the Lungs of the Infant, as hath been often said, are red and thicke, and are nourished with red and thicke Blood brought vnto them by Vessels hauing single Coats, that is, by Veines. Wherefore the Infant doth not Respire, because neither ought he if he could, nor can if he ought. *Rosset* objects, that by both the Inoculations there is plentie of Aire transported to the Infants Lungs, because it dilateth and contracteth his Chest. But if that were so, then should it follow that the Chest is moued after the motion of the Lungs; for the Lungs being puffed vp by the Aire inspired should enlarge the Chest; and againe falling vpon the expiration of the Aire should compresse the

Rosset objection answered.

the same. So the Lungs should not be filled because the Chest is distended as it is in a paire of Bellowes; but because the Lungs are filled the Chest should be distended as it is in a Bottle or Bladder, which to say were verie absurd, as *Galen* teacheth in a thousand places. For the Lungs follow the motion of the Chest for the auoiding of vacuitie, as in the next Booke we shall more plainly proue.

Neither is the distention and contraction of the Chest simply necessarie for the maintenance of life; for those Creatures which lurke in holes all Winter, we call them *χρυεῖς*, and some Women doe liue without that motion of the Chest. Respiration therefore in the *Embryo* or young Infant is not absolutely necessarie.

Some there be, who thinke that Infants doe Respire in the Wombe as diuing Fishermen, who will remaine more houres then one in the bottome of the Water, and returne fresh vp and laden with Fish. Why should not the Infant being warme in the Wombe as well liue, his Weazon haply a little helping him, as the cold Fisher draw Aire out of himselfe with his Mouth being compassed round about with cold Water? The same thing also they confirme by the authoritie of many authentick Authors. *Hippocrates* in his Booke *De Natura Pueri* saith: *First the Infant breatheth a little and draweth a little Blood from the Wombe; and his breathing is increased when he draweth more Blood, it descending more plentifully into the Wombe.* *Galen De Locis Affectis*: *If the Heart be deprived of Respiration, the Man must of necessitie instantly perish.* Is not the Infant a Man? Furthermore, Women feele their Infants to moue with Animall and voluntarie motion: Why therefore are not the Lungs and the Heart moued? As therefore in the first months when the Infant beginneth to moue, he is truly said to moue though it be obscurely: so though he breathes obscurely, yet he may truly be said to Respire. *Galen* in his fourth Booke *De Causis Pulsuum* saith: That Women with Child haue greater, quicker and swifter Pulses then they haue when they are not with Child; because they are compelled to breathe not onely for themselves but also for their Infants. But all these things doe proue indeed that Infants doe Transpire, but they doe not proue that they doe Respire. For, in respiration the Chest is contracted and distended, and Aire is breathed in by the Mouth and the Nose; which that it is not so in the Infant we haue already demonstrated. Indeed by the Vmbilicall Arteries there is Aire transported together with the spirituuous Blood into the whole Body of the Infant, and from the Arteries there are many Inoculations into the Veines; whence it cometh to passe that though the Arteries be tyed, yet the Creature doth not presently dye as being a while sustained by that Aire which the whole Body receiueth from them.

Respiration is not absolutely necessarie to life.

That the Infant doth respire. A comparison

Authorities.

The Solution of the arguments.

QUEST. XXVII.

Whether the Vitall Facultie which procreateth the Spirits is idle in the Infant, and whether his heart is moued by it owne proper power. A Paradoxe.

Concerning the life of the Infant, that is, how he exerciseth his Vitall Faculties there is a new Paradoxe, which we will discusse. I doubt not but at the first view it will seeme to many Men absurd, but if it be better attended I presume it will appeare so strong and so well supported with strong demonstrations that it will be hard for a contentious Spirit to shake them. The Paradoxe is this: *There is in the Infant no necessitie of the Lungs and the Heart, because he liueth without their officiall action.*

A paradoxe, that the Vitall Faculty of the heart in the Infant is idle.

This if I can proue, I shall ouerthrow the iudgement and determination of *Aristotle* and the *Peripateticks* concerning the foueraigntie of the Heart in Mans Body. The demonstration of our Paradoxe shall be wholly Physiologicall and Anatomicall.

The demonstration.

The Faculties of the Soule are reckoned by *Aristotle* to be three: The Vegetatiue, the Sensatiue and the Intellectuall. The Physitians account so many, but giue them other names: The Naturall, the Vitall and the Animall. That which the *Peripateticks* call the Vegetatiue differeth nothing from the Physitians Naturall: for as we say, the whole Naturall Facultie is contained in the *Increasing, Nourishing* and *Procreating* Vertues: so *Aristotle* in his second Booke *De Anima* saith: That the same vertues serue the Vegetatiue Soule. This Vegetatiue Facultie is common to all things that are animated, that is, which haue any kind of life in them, and proper to them onely. For all things that haue life are nourished, but the Vitall Facultie of the Physitians, which is the procreator of the Spirits of life, which shineth

in Respiration and in the Pulse, doth not appeare in Plants and things without Blood, because their cold and crasse Spirits are scarce at all expended or wasted. In hotter Creatures there was need of a Fire-hearth, from whence the vanishing heat of the particular parts might be redintegrated & refreshed by the influence of another. That lively and quickning *Nectar* is the Vitall Spirit which the Heart ἀρχὴ τῆς θερμότητος καὶ τῆς ζωῆς, the originall of heat and life, continually generateth of Blood and Aire mingled together by his admirable motion; as a Water-Engine worketh vp a Stream. That this Vitall Facultie of the Physitians doth not shine in the Infant neither yet his Heart moue by a proper & ingenite power although he liue, we are fully perswaded by these Arguments.

The first
argument.

What neces-
sitie there is
of the motion
of the Heart.

The Heart is moued to generate Vitall Spirits, and the same to diffuse out of his left Ventricle as out of a liuing Fountaine to the Canales of the great Arterie to refresh the fading and decaying heat, to supply by his fource of Vitall Spirits the liuelode of the particular parts. This is all the necessitie of his perpetuall motion, this the Finall cause. But in the Infant there is no generation of Vitall Spirits in the Ventricles of the Heart, neither are Vitall Spirits deriued from his Heart into the Arteries; Ergo his Heart moueth not, there being no necessitie of the motion.

The *Maier* Proposition of it selfe is cleare enough. For who seeth not that in the Diastole or distension of the Heart, both the matters of the Spirit Aire and Blood are drawne into the Heart? The Aire by the Venall Arterie into the left Ventricle, the Blood by the hollow Veine into the right. Againe, that in the Systole or contraction of the Heart both the sootie vapors which are the recrements of the Spirit are purged, and the Vitall Spirits driuen into the Pipes of the great Arterie as into water-courses. Insomuch that this generation of the Spirits which it accomplisheth by his perpetuall motion seemeth to be the onely official action of the Heart. The *Minor* Proposition is thus confirmed.

There is no
generation of
Vitall Spirits
in the Infant.

The Vitall Spirit is generated of Aire and Blood mingled together. Both the matters before they attaine the left Ventricle of the Heart doe stand in need of preparation. The Aire by his aboad in the substance of the Lungs attaineth a qualitie familiar to the in-bred Spirit. The Blood is prepared in the right, which they call *σπέρμα* and the bloody Ventricle. But in the Infant there is neither any plentie of Aire conuained into the Lungs (for the Weazon is idle) neither is there any Blood poured into the right Ventricle. There is therefore in the Heart of the Infant no Shop nor worke-house of the Vitall Spirits. That neither Aire nor Blood is deriued into the Ventricles of the Infants Heart is manifestly proued by the structure of his Vessels. For the Vessels are vnited; the hollow Veine and the Venall Arterie by a large hole, the great Arterie and the Arteriall Veine by an Arteriall Pipe or Canale: wherefore the hollow Veine doth not poure Blood into the right Ventricle, as it doth after we are borne, but into the Venall Arterie thorow that hole for the nourishment of the Lungs. The Venall Arterie leadeth not Aire but Blood, and that thicke and venall. The great Arterie doth not draw Spirits from the Heart but from the Vmbilicall Arteries, which it transmitteth by the Arteriall Pipe into the Arteriall Veine.

Now if the Vitall Spirits were generated in the left Ventricle of the Heart, what need were there of that Arteriall Pipe, seeing there is in the Heart a wide vessell which is diuersly dispersed thorow the whole substance of the Lungs, I meane the Venall Arterie? This surely is a strong demonstration whose force no Man can perceiue, vnlesse he be skild in Anatomy, for it dependeth wholly vpon ocular demonstration, and the credite of a Mans owne sight. But this we will establish by other reasons.

The second
argument.

There is no
necessitie of
new Vitall
Spirits.

There is in the Infant no necessitie of that common Store-house or worke-house of the Spirits, because the two Vmbilicall Arteries doe supply vnto him Arteriall Blood; and a sufficient proportion of Vitall Spirits and those verie pure and bright, as being made by the strong heat of the Mothers Heart. Nature doth nothing idly or in vaine, why therefore should she make two Vmbilicall Arteries if new Arteriall Blood were to be generated in the Infants Heart? You will say that the Mothers Arteriall Blood was vnprofitable, and not so fit for the vse of the Infant, and therefore it needed to be re-boyled by his Heart. But I desire to be shewed the wayes whereby that Arteriall Blood can be transmitted into the left Ventricle; by the mouth of the great Arterie it cannot passe togetherward because Nature hath bolted it with three Valves which looke from within outward; albeit we thinke with *Galen* that some small quantitie of the Blood sypeth into the Heart to nourish it and preserue his life. From the great Arterie it is freely poured into the Arteriall Veine through the Arteriall Pipe, but from the Arteriall Veine into the Heart there is no way

open:

open: for the Membranes or Values of this Vessell are open outwardly but closed within, which giue way to any thing that commeth out of the Heart, but doe intercept the returne of it into the Heart. Seeing therefore that the Arteriall Blood of the Mother doth not forsake the Arteries, neither hath any access vnto the left Ventricle of the Infants Heart, we cannot admit any new preparation of the old, or preparation of any new.

Againe, if the Spirit of the Mother and the Arteriall Blood be prepared for the nourishment of the Lungs, and for the conseruation of their heat, as *Petrus* would haue it: why also should not the other parts of the Body liue by the influence and illustration of the same Spirit? Or if the Heart of the Infant doe generate Vitall Spirits whereby the life of the whole is preserued, why shall it be thought insufficient for the preseruation of the Lungs which are but a little part of the whole? Wherefore the Infant truly liueth by his owne proper life, but he neuer engendreth new Spirits nor hath any vse of the motion of the Heart. Notwithstanding we must not say that therefore the Heart is idle, for Philosophers say, that is onely idle which doth not worke when it ought and when it can.

The third Argument

Why the heart of the Infant cannot be said to be idle.

The Heart of the *Embryo* neither can make Vitall Spirits, nor ought if it could. It ought not, because the two Vmbilicall Arteries doe supply both a sufficient number of Spirits and those also verie pure: neither can it, because there is a want of matter, for it hath no Aire which it should draw.

As therefore we doe not acknowledge any new Chylification or Sanguification in the Infant (for where should the Recrements of either of them be reserued or treasured for seuen months together.) So neither doe we admit a new generation of Vitall Spirits in the Heart of the Infant. But you will obiect, that Infants Arteries are moued, and all motions of the Arteries are from the Heart, because the Heart and the Arteries are continued together. Wherefore if the Arteries be moued together with the Heart, it will follow necessarily, that we must admit in the Infant the Vitall Facultie by which the Spirits are ingendred.

Obiection.

Answer. The Arteries of the Infant are moued after the motion of the Mothers Arteries. The first demonstration.

I answer, that the Arteries of the Infant are indeed moued, but that their motion followeth or floweth from the Arteries of the Mother, so that his Arteries doe not bear by a proper and ingenite facultie of their owne, nor by any power issuing from his Heart, but by a force and efficacie transmitted from the Heart and the Arteries of the Mother. That these things are thus, this elegant demonstration I thinke will sufficiently proue. It is most certaine that the Veines and the Arteries of the Wombe doe so adhere to the Veines and Arteries of the *Chorion*, that both Arteriall and Venall Blood doe flow out of one vnto the other. And this continuitie of the Vessels, *Galen* maketh often mention of, for in his Booke *De Dissectione Vteri*, he saith, *The end of that Vessell which is propagated thorow the Wombe, giueth beginning to that which is in the Chorion, so that you may call these two one Vessell*, for their mouthes are so vnited, that the Veine draweth Blood from the Veine, and the Arterie Spirit from the Arterie.

Answer.

If this be true in the Arteries so opening into the mouthes either of other, it must needs follow that the end of the Arterie of the Mothers Wombe when it beateth must driue Arteriall Blood into that part of the *Chorion* which is continuall therewith, otherwise that Arteriall Blood must either recoyle into the Wombe out of the which it is issued, or else there must be a conculcation of two Bodyes confused and mingled in the same time and place, mutually penetrating one the other; whence it shall come to passe, that if we grant there is a Dilatation in the *Dyafole*, we must also yeeld that there is at the same time and in the same Vessell a compression in the *Systole*.

The second

Furthermore, is it not true which the Philosopher so often vrgeth, that a part of that which is continuall being moued, the whole is moued vnlesse it be hindred? The Arteries of the Infant are continued with the Arteries of the Mother; therefore when the Mothers Arteries are dilated, it is of necessitie that the Arteries also of the *Chorion* must be dilated. But if that Pulsatiue Facultie did flow from the Heart of the *Embryo*, there should flow also Vitall Spirits from the left Ventricle into the Arteries of the Infant, which alwayes be accompanied with Arteriall Blood, and so the Arteriall Blood of the Mother should be alwayes mixed with the Arteriall Blood of the Infant; and there should be a double motion in the Arteries of the Infant, one from the Heart of the *Embryo*, the other from the Mothers Arteries which would not be answerable but contrarie the one to the other.

We conclude therefore, that the Arteries of the Infant are moued after the Mothers Arteries.

Arteries, because they are continued with them: and therefore that that Vitall Facultie which procreateth the Vitall Spirits and the Arteriall Blood, must by no meanes be admitted to be in the Infant.

*Galen's
opinion*

Galen sometimes seemeth to haue beene of this opinion: for in his Booke *De Formatione Fetus*, he saith, That the Infant liueth after the manner of a Plant, and therefore standeth neither in need of the action of the Heart nor of the Braine, as neither of the Eyes nor of the Eares. As therefore a Plant oweth all his life vnto the Earth, so the Infant oweth all to the Mother. Yea sometime he saith, that the Infant is as it were a part of the Mothers body. As therefore a part of the Body needeth not any particular respiration, nor any particular Stomacke to digest his Aliment, yet of necessitie requireth the pulsation of Arteries: so the Infant liueth contented onely with transpiration, which is accomplished by the *Diastole* and *Systole* of the Arteries.

Galen.

In the 21 Chapter of his sixth Booke *De Vsu Partium*, *Galen* saith: We need not wonder that the Heart of the Infant to his proper life needeth but a little Spirit, which he may draw out of the great Arterie, seeing it sendeth neither Blood nor Spirits to the Lungs nor to the Arteries of the whole Body as it doth in perfect Creatures. Where marke that he saith, The Heart may draw a little out of the great Arterie. For the Values or Flood-gates there set by Nature, doe not hinder a little Arteriall Blood and Spirits from sypping into the Heart, but they hinder a sudden and plentifull confluence, such as should be necessarie, if of them the Heart should make Vitall Spirits and Arteriall Blood for the whole Body of the Infant.

*The contrarie
opinion.
That the Ar-
teries of the
infant are mo-
ued by a pow-
er issuing from
his Heart.
Authorities
out of Galen:*

This I say was *Galen's* opinion: yet in many places he seemeth to say the quite contrary: that the Arteries of the Infant are moued by a facultie sent from his Heart vnto them, and that the Heart it selfe is moued by an in-bred and proper motion. In the 22 Chapter of the seventh Booke *De Vsu Partium*: The Heart (saith he) not onely in perfect Creatures but also in Infants supplyeth to their Arteries the power by which they are moued. And in the 21 Chapter of the sixth Booke: If you tye the Arteries of the Nauell whilst the Infant is in the Wombe, all the Arteries which are in the Chorion will cease beating, and yet those Arteries which are in the Body of the Embryo will continue their pulsation: but if with the Vmbilicall Arteries you tye also the Vmbilicall Veines, then will the Arteries which are in the Body of the Infant leaue beating also. By which it is manifest, first that that power which moueth the Arteries of the Chorion proceedeth from the Heart of the Infant: Againe, that the Arteries get Spirits from the Veines by their Inoculations. In the same Booke in another place he saith: The Heart in the Infant when it dilateth it selfe, draweth Blood and Spirits from out of the Venall Arterie. In the ninth Chapter of his Booke *De Formatione Fetus*: When the Heart of the Infant cometh to haue Ventricles, and hath receiued Venall and Arteriall Blood, then it pulseth, and together with it selfe moueth the Arteries, so that it liueth now not onely as a Plant, but also as a Creature. This opinion may also be confirmed by reasons.

*The first
Argument*

Seeing the Heart is the hottest of all the Bowels and as it were a Fire-hearth, if you de- priue it of motion it hath nothing left wherewith it may be refrigerated; by transpiration it cannot, because it is included in a hot and narrow roome; nor by the appulsion of exter- nall aire, for the soliditie and thightnesse of the Membranes wherewith it is compassed hinder the access thereof: add hereto that those warry Excrements in the *Pericardium* doe hinder the perspiration. Neither hath the Heart of the Infant any refrigeration from the Mothers Arteries by the access of a new Matter or Spirit, for nothing can arriue into the Heart of the Infant from his Arteries because of the Membranes which lye vpon the mouth of the great Arterie.

*The second
argument.*

*Histories
of many cut
out of their
Mothers
Wombes.*

The motion therefore of the Heart was necessarie, by the benefite whereof both Blood and Spirit are drawne into it, and from thence communicated to the whole Body. The credite also of this opinion is encreased by Histories: for many Women report that some haue beene cut out of their Mothers Wombe after they were dead and so saued; as *Scipio* and *Manilius*. The Ciuill Lawyers doe condemne him as a Murtherer that shall bury a Woman great with Child before he hath taken the Infant from her, because together with the dead Mother he seemeth, or is held in construction, to haue buried a liuing Infant: which Law being made with the consent of Physitians, doth sufficiently declare that the Infant may suruiue after the Mother is dead. It is reported that *Gorgias* the *Epirote*, after his Mother was dead and vpon the Bier to be buried, issued aliue from her wombe, which could not haue been vnlesse the Heart of the Infant had had in it Vitall facultie, which with- out the assistance and communion of the Mothers Heart for a while did sustaine his life.

But

But I thinke it will not be hard to giue a sufficient answer to all these Authorities and Arguments. For *Galen* authoritie we make the lesse account of it, because it contradicth himselfe. Moreouer, we say that the experiment which *Galen* biddeth vs try is impossible, for you cannot intercept the Vmbilicall Veine and Arteries of the Infant vnlesse the Mother be dead & her Wombe opened, and then we say the Infant doth respire not transpire. And whereas they say that the Heart hath not wherewith it may be refrigerated vnlesse it be moued. We answer, that the Infant contained in the Prison of the Wombe, hath sufficient for the preservation of his life from the Mothers Arteries, because it liueth as those Creatures doe, which the *Grecians* call *ομαλόντα ζῷα*, beside it receiueth some refrigeration from the luke-warme Water wherein it swimmeth.

Answers to the Authorities and arguments.

The last reason from the cutting out of liuing Infants out of their dead Mothers, may seeme to some to vrge much, but the answer is at hand. That the Vitall Facultie diffused through all the Arteries, without the communion of the Heart may for a short time preserue the Infant alieue after the Mothers death.

We haue seene (saith *Galen* in his second Booke *De Placitis*) a sacrificed Beast walke after his Heart was taken away, and haue often made experience of the same in a Dogge. What also if I shall say, that those Mothers were Hysterical and esteemed as dead when yet they were alieue, which thing is not vnusuall? The truth therefore of our opinion remaineth firme, that the Heart and the Arteries of the Infant doe pulse or beat from a power proceeding from the Heart and Arteries of the Mother, not from any proper and ingenite facultie of their owne, and that no new Arteriall Blood is generated in his left Ventricle, seeing the Mothers Arteries doe supply a sufficient quantitie, and that verie pure.

Galen.
The Conclusion.

From hence let the *Peripateticks* learne, how vnadvisedly *Aristotle* calleth the Heart the first Liuer, Mouer and Blood-maker. For both the Arteries of the Infant doe moue before his Heart, and the Heart liueth onely by the pulsation of the Arteries. Finally, as long as the Infant is included in the Wombe of his Mother, we doe not beleue that his Heart is the Shop or Store-house either of Vitall Spirits, or of Arteriall Blood.

Against the Peripateticks principally of the Heart.

QUEST. XXVIII.

Whether there be in the Infant any generation of Animall Spirits, and what position the Infant hath in the Wombe.

THE Mouing Facultie floweth into the Flesh of the Muscles from the Braine by the Nerues, not by a simple irradiation or separated qualitie, but by a Corporeall Substance, which the Physitians call *Animalem Spiritum*, an *Animall Spirit*. Seeing then the Infant in the Wombe moueth of his owne accord some times to the right side, some times to the left, and often times kicketh with his Heeles, it followeth necessarily that he hath Animall Spirits. But whether he draweth these from his Mothers Wombe as he doth the Vitall, or generateth them in the webbes or substance of the Braine by a proper and in-bred facultie, it hath of long time been a great question. I thinke that they are generated in the Braine, and my reasons are these: Because there is no communion or connexion betweene the Nerues of the Wombe and of the Infant, as there is betweene their Veines and Arteries. Now onely the Nerues conuey the Animall Spirits.

The generation of the animall spirits in the Infants.

You will obiection, that the Animall Spirit standeth in need of Aire for his conseruation and expurgation, but no Aire is inspired as long as the Infant is in the Mothers Wombe.

Obiection.

I answer, that this Animall Spirit is cherished, purged and tempered by that transpiration which is made by the Vmbilicall Arteries, but his generation we thinke to be the same in the Wombe that is after the Infant is borne, which how it is we shall declare more at large in the seuenth Booke where we shall of purpose entreat of it.

Solution.

Concerning the time of the Infants motion, *Hippocrates* seemeth not alwayes of one mind. For in his Booke *De Morbis Mulierum* he saith, *That Male Children moue the third month, and Females the fourth.* But in the third Section of his second Booke *Epidemion* he saith, the Infant is moued the 70 day, in these words: *whatsoever is moued the seuenth day is perfected in the triplicities.* And in his Booke *De Nutritione*: *Thirtie dayes forme the Infant, seuentie moneth it, and two hundred and ten perfect it.* You may reconcile *Hippocrates* to himselfe in my opinion, if you say, that there is one motion obscure, another so manifest that

In the time of the Infants motion *Hippocrates* varieth.

The places reconciled.

the

That the Infant may moue at eight weekes

Concerning the position of the Infant, different places reconciled.

A diuers reading in Hippocrates.

How both readings are made good.

the Eye may iudge of it and the Hand may feele it if it be layd vpon the Belly. In 70 daies the Infant may moue, but the motion shall be neither visible nor to be felt till after the third or fourth month. And surely my selfe haue knowne a Woman in three Children confidently auouch, that after eight or nine weekes she hath alwayes felt her Infant moue verie sensibly, which I could not belieue, till I had well considered of this place in *Hippocrates*.

Concerning the position also or scituation of the Infant in the Womb, which is referred to the mouing Facultie, there are some places which need to be reconciled. *Hippocrates* in his Booke *De Natura Pueri* saith, that in the wombe the Infants Head is neere vnto his Feet. *Thou canst not iudge* (saith he) *though thou shouldst see an Infant in the Wombe, whether his Head be placed above or below.* But in his Booke *De Oetimestri Partu* he writeth, that the Head is placed in the vpper part of the Wombe, in these words: *All Infants are begotten hauing their Heads upward.* *Aristotle* in the eighth Chapter of his seuenth Booke *De Natura Animalium*, seemeth to reconcile these places on this manner: *All Creatures* (saith he) *in the first months after their Conformation beare their Heads upward, but when they increase and grow toward their birth, their Heads bend downward.* Againe, in *Hippocrates* Booke *De Natura Pueri* almost all Copies haue it thus: *The Infant seated in the Wombe hath his Hands at his Cheekes.* Yet all Interpreters translate it *Ad Genua, At the Knees.* I thinke that both Readings may be maintained: For there are some Copies of both Readings. For the Infant hath his Hands at his Cheekes and at his Knees. The palmes of his Hands take hold on his Knees, and the backs of his Hands touch his Cheekes. For, if as *Aristotle* writeth in the place next before quoted, the Infant is so rowled vp that his Nose is betwixt his Knees, his Eyes vpon his Knees, his Eares on either side his Knees, and that with his Hands he takes hold of his Knees, he must necessarily rest both his Cheekes vpon his Hands. Those things some haue written of the different scituation of Males and Females, are but deuices of their owne Braine. But those things which *Aristotle* hath written in his seuenth Booke *De Natura Animalium*, concerning the different scituation of diuers Creatures, are well worth the obseruation and our knowledge: Notwithstanding, I doe not thinke fit to transcribe them here, but referre him that desireth satisfaction vnto *Aristotle* himselfe.

And thus much shall be sufficient to haue spoken of the Infant all the while he is contained and contenteth himselfe with the Prison of the Wombe: it remaineth now in the last place, that we speake of the birth of the Infant.

QUEST. XXIX.

Of the nature and differences of the Birth.

WE now enter into a vast Sea, a huge and enorme Tract when we vndertake to dispute of the Nature, Times & Causes of the birth of Man; wherein we shall meet with many contrarie gusts of opinions, many vnpassable and thorny wayes. How many reciprocall Waues in the concertations of the Ancients? How many Quick-sands in the accounts of months and dayes? How many Rockes in the search after the causes of things? Amongst which vnlesse a Man be well steered by Reason, he must needs set vpon some misadventure. Notwithstanding, so necessarie and profitable a Voyage this is, as we will aduenture our selues; the Pole we are guided by is fixed Truth, and the Pilot shall be *Hippocrates*, who as saith *Macrobius*, *Could neuer deceiue or be deceiued*: out of his Bookes *De Septimestri & Oetimestri Partu, De Natura Pueri, De Principijs, De Alimento, and De Morbis Mulierum*, will we draw our Demonstrations.

But that we may proceed in order through the whole course of our Disputation, that the capacities of such as are not thorowly grounded may not be confounded, we will diuide our Discourse into three Heads. In the first we will open vnto you the Nature of the Birth and all the differences of the same. In the second, we will handle the Times of the Birth by a computation of the yeeres, the months and the dayes. In the last place, we will manifest the Causes of the varieties of the Birth, as well the Generall as the Particular, the Naturall, the Physicall, the Arithmetically, the Gometricall and the Astrologically Causes.

To begin therefore with the first. The Birth, which the *Grecians* call *τόκος*, we define to be an Edition or bringing into the world of an Infant perfected & absolued in the wombe,

Three heads of the question.

What a Birth is

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so that whatsoeuer month, day or houre the Infant arriueth into the World, that arriually may properly and truly be called the birth. To this perfection we speake of, there is required not onely a Dearticulation of the Parts, for then if a Woman should miscarrie at foure months that miscarriage should be called a Birth; but also their strength and growth, which because the Infant attaineth not before the seuenth month, we cannot properly call it a Birth before the seuenth month, but either an abortment or a miscarrying. An Abortment the *Grecians* call by diuers names, ἀποθράν, ἀμβλωσις, διαθράν, ἐκτρωσις, ἐμβελόν, ἐκτρωμα, κύημα ἀνεμαίον. We therefore define an Abortment to be either the issuing of an imperfect Infant or his extinction and death in the Wombe. Some there are who will not haue it called an Abortment before the Infant hath moued, so that a Woman shall not be said to abort but from the third month to the seuenth, and that before the motion it shall be called an Effluxion or miscarriage.

What is required to a perfect birth.

The names of the Abortment.

The definition.

The error of some.

But these Men seeme to me not to conceiue *Hippocrates* meaning aright: For *Hippocrates* after the *Embryo* is formed vseth to call it an Abortment if it come before the due time, whether it be before the motion of the Infant or after it. As in the 44 Aphorisme of the first Section: *Those women that are too much extenuated doe abort at two months.* And in the Aphorisme following in the same Section: *Those that are naturally disposed doe abort at three months.* But if the Geniture be auoyded before Conformation, then is it not properly called an Abortment, but *εκπαις*, an Effluxion, so saith *Hippocrates* in his Booke *De Septimestri Partu*: *Those corruptions which happen a few dayes after the Conception, are called Effluxions not Abortments.* *Aristotle* also in the fourth Chapter of his seuenth Booke *De Natura Animalium*, calleth those corruptions which fall out before perfect conformation, *Effluxions*. Wherefore some say that *Hippocrates* is not to be accused of impietie or of breach of his oath, because he counselled the dancing Dame he calleth *Psalteria* to prouoke an Abortment, because she lost not an Infant, but suffered onely an Effluxion seuen dayes after she had conceived.

Hippocrates.

What an Effluxion is.

Hippocrates ill excused.

But howsoeuer we in Schooles may distinguish thus nicely, yet God iudgeth after another manner as we may perceiue by his iudgement vpon *Onan*. Neither doe we by Abortment onely vnderstand an exclusion of an imperfect Infant, but we say that a Woman may abort in her Wombe though the *Embryo* be not brought away: So saith *Hippocrates* in his first Booke *De Morbis Mulierum*: *When a woman aborteth and the Infant is not excluded.* So that Abortment signifieth not onely an exclusion of the Infant before the due time, but also the extinction or death of the same in the Wombe before the due time of birth. For an Infant may be carried in the Wombe after he is dead many yeeres, as may be proued by many examples. Among the rest that is notable, of the Infant which the Mother bare in her Wombe 28 yeeres which was turned into a Stone, as it is recorded by *Iohannes Albosius* a learned Physitian. Likewise, that about *Newarke* not many yeeres since, which after it dyed in the Mothers Wombe remained there a good space, and after was vomited vp by peece-meale out of the Stomacke: a Storie past all beleefe fauing that it hath so many Eyewitnesses yet living and ready to iustifie the truth of it. Thus we see out of *Hippocrates*, what is a Birth, what an Abortment, and what an Effluxion. To wit:

His large acceptance of an abortment.

Two strange stories.

Octimestris partus is not an abortment.

Birth is when an Infant perfected in the Wombe commeth into the World whether it issue aliue or dead: so that they are in no small error who call the Infant of eight months old an Abortment, because it is not aliue: for it is not simply and absolutely of the essence of the birth that the Infant should be borne aliue, but that it should be borne perfect, now at eight months it is perfect. To be aliue or not aliue, to be legitimate or not legitimate, are differences of the Birth as we shall say by and by. An Abortment is an exclusion or extinction of an vnperfect Infant. An Effluxion or miscarriage is an auoyding of the Geniture before perfect conformation.

The differences of the birth.

The first condition required in a naturall birth.

Having thus made plaine the nature of the Birth, we come now to the differences thereof. A Birth is either Naturall or not Naturall, Legitimate or Illegitimate. To a Naturall Birth three things are required: The first, that there be an equall contention of the Infant and the Mother. For the action of the birth is common both to the Infant and the Mother. But to which of these we ought to attribute the beginning of the motion, whether to the Wombe or to the Infant, *Galen* expoundeth in his Commentary vpon the 37 Aphorisme of the fifth Section: *The Infant bringeth to the Mother the beginning of the Birth.* For being become larger and hotter and needing more store of Aliment and Spirit, with often and violent motions of his Hands and Feet he breaketh the Membranes, and the Wombe

OUCE-

ouer-burdned with so great a weight and so vnruely an Inmate, desiring to lay downe her vnwealdy burden, wholly contracteth it selfe to the shutting out of the Infant: So that from an equall contention of the Infant and the wombe, the Birth proceedeth *natura quoniam, according to Nature*. But if neither of them endeauour, or but one of them fayle, then is the Birth *not Naturall*. For if all the worke lye vpon the hand of the Mother, then is the Birth hard and laborious; Now that hapneth when the Infant is weake, or his strength spent, or he be dead; which *Hippocrates* expresseth in these words, in his first Booke *De Morbis Mulierum*: *The Birth is then most difficult when the Infant issueth either dead or apoplecticall*, that is, depriued of motion and sence.

The second condition.

A description of the naturall figure.

Why the head forward is the most naturall figure.

Why dead men are caried with their feet forward.

Diuers vnaturall figures of the birth.

Agrippa why so called.

The third condition.

The second condition of the Naturall Birth is, that it come forth in that figure which is according to Nature. This figure *Hippocrates* first of all Men described in his first Booke *De Morbis Mulierum*, and in his Booke *De Natura Pueri*, and *De Octimestri Partu*: *The Child commeth with his Head forward if he come according to Nature*. Now why this figure and forme of issuing is according to Nature, *Hippocrates* rendreth a reason. *Because the Infant hanging vpon the Nauell as a Ballance vpon a Beamie, his upper parts are the heauier*, and therefore his Head turneth sooner downward. Add hereto that if the Infant come with his Head forward, the rest of his parts being flexible like Waxe doe not hinder the Birth but yeeld and giue way vnto it: But if he come with his Feet forward, his Armes may be so spread and extended that they may hinder the rest of the Body. And this is *Hippocrates* opinion in his Booke *De Octimestri Partu*: *The flexible parts of the Infant are no hindrance vnto him if he issue with his Head forward: but if he come with his Feet forward, then they stop the passage*. That this figure of the Head forward, is the most naturall and safe way for the Infant, *Pliny* confirmeth in the eighth Chapter of his seuenth Booke *De Naturali Historia*. *The old custome is (saith he) that dead Folke are carried to their Graues with their Feet forward, because death is contrarie to life*. As therefore a Man commeth into the World with his Head first, so being dead he must be carried out of the World with his Feet first.

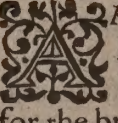
Besides this, all other figures of the Birth are to be called *not Naturall*. Now there are diuers figures of the Birth *natura quoniam, not Naturall*, but three especiall; with their Feet forward, with the side first, or double; all which *Hippocrates* expresseth in his Books *De Morbis Mulierum* and *De Natura Pueri*. *It is dangerous when the Feet come forward, for in such a Birth oftentimes the Mother perisheth, or the Infant, or both together*. To deprecate or auert this danger, the ancient *Romanes* built Altars to the two *Carmenta*: the one of them was called *Postuerta*, the other *Prosa* of the right or wrong proceeding of the Birth. And such Births are commonly called *Agrippa*, as it were *Egre partus*. So *Agrippina* said her Sonne *Nero* came into the World with his Feet forward.

The third condition of a Naturall Birth is, that it be swift, easie and without any vehement *Symptomes*. I call that a lawfull or legitimate Birth which commeth in due time: and that illegitimate which hapneth before or after the due time. The eighth month Birth is illegitimate, because it preuenteth the ninth month or stayeth after the seuenth month: and this is the Nature of the Birth, these are all the differences thereof.

QUEST. XXX.

How many times there be of a Mans Birth, and what they are.

Aristotle. The times onely of mans birth vncertaine;

 *Aristotle* that Genius and Interpreter of Nature, as he hath in all things acquitted himselfe wondrous well; so herein also he hath written excellently, that whereas Nature hath appointed almost to all Creatures a determinate and certaine time for the bringing forth of their young; circumscribed and constant limits of their gestation: yet to Man she hath granted a larger and freer Patent for the time of his procreation and gestation. House-Doues doe euerie month bill and breed young: A Bitch whelps at foure months: A Mare foales the ninth: And an Elephant the second yeere: Onely Man hath diuers times wherein he is brought forth, the seuenth, eighth, ninth, tenth and eleuenth months. This Women doe all of them confesse, whom we ought to beleue, saith *Hippocrates* in his Booke *De Septimestri Partu*, because they are most skilfull in this kind of learning.

This

This also is confirmed by the authority of *Hippocrates*, *Aristotle*, *Plutarch*, *Galen* and *Aphrodisæus*; and beside by certaine laws of the Romanes. The seuenth month, is the first limit of a mans birth, and before seuen months, no Infant suruiue, albeit some Egyptians, the Poets of *Naxos*, and many Spaniards report that some haue bene borne alieue the sixth month.

The 7. month
the first time

The seuenth month birth, *Hippocrates* saith is vitall or doth suruiue, in his Booke *De Principijs*. The Infant borne the seuenth month is reasonably borne & liueth. He is reasonably borne because he wanteth nothing in the perfection of his parts; for in the two months following there is nothing added to the perfection of the parts, but vnto the perfection of his strength.

The 7. month
childe Vitall.
Hippocrates.

Aristotle in his 7. Booke *De Natura Animalium* affirmeth the same, as also *Aphrodisæus* in his Problemes. *Galen* in his Commentary vpon *Hippocrates* booke *de Septimestri partu* saith, that he hath seene many children borne the seuenth month suruiue and do well. The same in Honor of *Hippocrates* was concluded by the Roman Lawes, and standeth in force at this day euen among our selues.

Aristotle.
Galen.

Lawes of the
Romanes.

Pliny reporteth, that *Sempronius* and *Corbulo*, two Consular Romanes, were borne of their Mother *Vestilia* the seuenth month. I haue also credibly heard it reported, that that good old man Doctor *Turner* of *S. Ellins* now lately gone to heauen, was borne the seuenth month and preferued by some small sustenance till he was able to suck, which was about two months after he was borne. And if you obiekt *Hippocrates*, who in his booke *de Septimestri partu*, saith, that there be few seuenth-month children, and of those few many perish, and therefore *Aristotle* biddeth that they should be laide in wool and carefully swathed. I will giue you this answer, that there are many seuenth-month births, because there is a great latitude of the 7. month.

Pliny.

D. Turner.

Obiection.

Solution.

Those that are borne in the beginning of the seuenth month may indeed liue, but they are exceeding weake and do not recouer strength in forty dayes, and of these we must vnderstand that place of *Hippocrates*, for he saith they are borne after 182. dayes, and a part of a day, now 182. dayes do make but the beginning of the 7. month. But those that are borne in the end of the 7. month, that is, after 210. dayes are strong, and few of them perish. Of such he speaketh in his Booke *de Principijs*, where he saith, The 7. month-Infants are borne according to reason, & do liue because they accomplish three tenths of weekes, and every tenth fulfilleth 70. dayes.

The difference
of the 7. month
Infants.

Againe the 7. month Infant is either a Male or a Female; A male because he is sooner formed, mooued and perfected in the wombe, if he be borne the 7. month he suruiue. A Female because shee keepeth not that proportion which is required to the Conformation, Motion and Birth, if she be borne the 7. month she wil haue life, but not hold it long. This first rule we establish as a Law, that the 7. month childe is legitimate and vitall, and that this is the first limit of a mans birth. The bringing forth of a childe at 8. months is called, not an abortment, a birth, but yet it is neither a vital nor a legitimate birth. *Hippocrates* in his Booke *de Principijs*. No Infant borne the 8. month suruiue, and the same he repeateth in his Booke *de Octimestri partu*, and *de Alimento*, elegantly indeed, but very obscurely, where he saith, The birth of 240. dayes (such is the 8. month birth) is and is not. As if he should say, the Infant is indeed borne the 8. month, but so, that it had as good not haue bin borne, because it cannot suruiue.

The 8. month
Infant is not
Vitall.

In Egypt where that fruitfull *Nilus* runnes, and in *Spaine* where women haue easie trauels, and where the heauen and the earth agree together to be kinde to man, there many men say, that some 8. month Infants do liue. *Asclepiades* saith, that the women of *Naxos* doe bring forth their children alieue the 8. month, and they suruiue either because *Iuno Lucina* hath giuen them this priuiledge for *Bacchus* sake, or becaule *Bacchus* was borne that month, after whose name it is called *Dionysia Naxos*. But these are vaine things, and beside are different from the Vniuersall Nature as the Philosophers speake. Add hereto, that in the account of the months women are often deceiued, so that they seeme to themselves to bring forth the eight month when it is indeed the 9. for there are some whose courses flow the 2. month after their conception, and such women think they haue not conceived when indeed they haue conceyued.

In Egypt some
suruiue at 8.
months.

Aristotle in his 10. Booke *de historia Animalium* sheweth how there may many errors happen in the computation of the time of their conceptions. There are some (saith he) who thinke that there can be no conception vlesse both parents do at the same time eiaculate their seed. Now such are deceiued; because the body that is best disposed soonest looseth, wherefore that seed being very strong is not corrupted, but beeing drawne it is referued for that mixtion which is to be afterward.

How women
are deceiued in
the account of
their Con-
ceptions.

They erre also who thinke they haue not conceived vlesse the wombe be dry and all the seed be retained; because of the whol seed which proceedeth as wel frō the man as from the woman, the matrix draweth first no more then it can, then no more thē it should draw. Many

Many women
thinke they
haue concei-
ued when they
haue not.
The 9. month
birth is most
legitimate.
The 10. month
birth vitall.

women therefore haue conceiued which thinke they haue not conceiued, and these doe easily mistake the sixt for the seuenth, the eight for the ninth months.

The nine month birth is of all other the most vitall and legitimate, as that which is in the middle of the two extreames, and is beside most familiar to nature. Concerning the ten month birth *Hippocrates* hath written many things in his Books *de natura pueri*, & *de septimestri partu*. *Homer Odiss.* maketh *Neptune* to speak thus vnto the *Nimphe*. After a yere is accomplished thou shalt bring forth a beautifull burthen. That is to say, the tenth month, for of ten months consisted the yere among the *Aolians*, as also among the ancient Romanes, now *Homer* we know was an *Aolian*.

11. month
birth contro-
uersted.
How women
are deceiued in
their computa-
tion.

Concerning the eleuenth month birth there is great difference among authors; *Hippocrates* seemeth to haue conceiued diuersly of it; in his Book *de Natura pueri* he determineth that the tenth month is the longest limit of gestation, within ten months at the furthest saith he, the Infant is borne. But those women who thinke they go vnto the eleuenth month are deceiued in the number of dayes and computation of the time of their conception, for sometime the womb is distended with winde and breedeth a false conceit of their being with childe. Oftentimes vpon the suppression of their courses their bellies swell and they thinke they are conceiued, making their accompt from the time of that suppression.

Aristotle vnto
thankfull to
Hip. his good
maister.

Aristotle, who indeed tooke all that he writ concerning the Nature of Creatures only from *Hippocrates*, and yet (vngatefull man as he is, neuer maketh mention of him) reprooueth those women who say they haue borne their children eleuen and twelue months. The beginning saith he, of Conception most women are ignorant of, especially if they couple and conceiue when before their wombes are distended with winde; for then they esteeme that they haue conceiued when their bellies beginne to bee distended, whereas indeede they are first distended with winde and afterward conceiue: For *Hippocrates* determineth that the tenth month is the utmost limit of gestation; (and *Ulpianus* the Lawyer admitteth no children to the inheritance who were borne after the tenth month;) but in his Booke *de septimestri* and *octimestri partu*, he acknowledgeth the 11. month.

Hip reconciled
to himselfe.

You shall reconcile *Hippocrates* to himselfe, if you say, that the end of the tenth month is the absolute and longest limit of gestation, & that a woman cannot fulfil eleuen compleat months, but if she bring forth in the 11. month it is in the beginning thereof, and that is *Hippocrates* meaning when in his Book *de octimestri partu* he saith, that some women carry their burthens vntill the eleuenth month, he meaneth vnto the beginning of the 11. month.

Auicen of a
birth at 14.
months.

As for the twelfth, the thirteenth and the fourteenth months *Masurius* reporteth that *L. Papius* the Pretor awarded an inheritance of Land against an heyre whose mother confessed that she bore him after thirteene months; because the time of his birth seemeth to him to be litigious. *Auicen* writeth that he saw a childe borne fourteene months after Conception: but if any such thing happen, we conceiue it to be a rare accident and beyond the consideration of Art.

Auicen of a
birth at 14.
months.

We conclude therefore that the first limit of a mans birth is the seuenth month, the last is the 11. the intermediate times are the ninth and the tenth.

Auicen of a
birth at 14.
months.

Now what are 7. month, 8. month, nine month and ten month births, and of how many daies euery one of these consisteth, and also what account and supputation of dayes we are to make, it remaineth that we should declare, for vpon this Axle-tree is the whole Controversie rowled; this labyrinth hath innumerable windings and turnings, out of which no man shall be able to redeeme himselfe who is ignorant of *Hippocrates* computation of months, decades, weeks & dayes; wherefore we will a little while stay our reader vpon the consideration of them.

Mensis Solaris.
Mensis Lunaris.

A Month according to the Astrologians is manifold, one called *Solaris* another called *Lunaris*, a third Common, that is to say, according to the *Iulian* Kalender. That is called a Solary month wherein the Sunne runneth through thirty degrees of the Zodiacke, and it containeth perpetually thirty dayes. The Lunary month according to *Galen* is double, the one of *Progreffion* the other of *Apparition*. The month of *Progreffion* he calleth that space which commeth betweene one conjunction of the Moone with the Sunne and another, and it containeth nine and twenty dayes and a halfe. A month of *Apparition* consisteth onely of 27. dayes, because three dayes are subtracted wherein the Moone lurketh as it were and giueth not her light. The

Mensis Solaris.
Mensis Lunaris.

Common month or the month of the Kalender doth not alwayes consist of the same number of daies. For the month of February hath 28. dayes, Iune 30. Iuly 31. And this is the variety and difference of months. Now what is *Hippocrates* month is very difficult to determine, some doe thinke it to be the Lunary, and the Lunary of *Progreffion* onely. And this may bee warranted

Mensis Solaris.
Mensis Lunaris.

Mensis Solaris.
Mensis Lunaris.

ranted by the authority of *Hippocrates*: for in the beginning of his Booke *De Septimestri partu* he writeth, that two months consist of 59. daies, and that 5. months are accomplished of an 147. daies and a halfe. Now five times twenty nine, make an 145, whereto if you add 2. daies and a halfe, the summe will amount to 147. daies and a halfe; so that euery month shall containe nine and twenty daies and a halfe. *Galen* in his Computation of the Criticall daies and the daies of Gestation, accounteth according to the Lunary month, and in his Commentarie vpon *Hippocrates* Booke *de Septimestri partu* is of opinion that no Infant suruiueth after two hundred and foure daies.

We on the contrary do imagine that *Hippocrates* months are Solary consisting of 30. daies, as we gather by his owne computation. For in his Booke *de Principijs* he saith, that the 7. month birth hath three Denaries or *Decades* of weekes, and in euery *Decade* are 70. daies; and that 3. *Decades* of weekes make 210. daies.

If therefore the 7. month birth do accomplish 210. daies, then euery month shall containe 30 daies, because seuen times thirty makes two hundred and ten.

Againe, in the same Booke he writeth, that a perfect birth is not accomplished till nine months and ten daies, but nine times thirty makes 270. whereto if you add ten, the sum will amount to two hundred and eighty.

Moreover, in his Booke *De Alimento* he writeth, that the birth at two hundred and forty daies, (by which all men vnderstand the eight month birth) is and is not: now two hundred and forty daies make eight Solary months. Furthermore in the third Section of the second Booke *Epidemion*, Whatsoeuer is mooued within seuentie daies, is perfected within the triplication. Now three times seuentie make two hundred and ten, which accomplish seuen compleate months.

Finally and most manifestly in his Booke *de octimestri partu* he teacheth that we must make our computation of months in the gestation of the Infant by the Solary months consisting of thirty daies. The new Moone (saith he) is one day, and the thirtieth part of the month. Two daies make the fiftieth part of the month, and three daies a tenth; wherefore we conclude, that the months of the birth are Solary rather then Lunary. And truly the efficacy and power of the Sunne is more auailable to generation then that of the Moone, whence it is that *Aristotle* in the second of his *Physicks* calleth the Sun *Stellam Salutarem* and *verum*, that is, a healthfull and fruitfull Starre, because it is the parent and procreatrix of all things. For the Sun and a man do generate a man. As for the Decads and weeks of *Hippocrates*, there is no reason we should much trouble our selues about them, for they are as cleare as the midday-sun it selfe. Euery *Decade* containing seuentie daies, and euery weeke seuen.

One scruple there remaineth to be remooued, wherewith I confesse I was a great while puzzled, and that is, why the Computation of daies to make the seuenth month birth is not one and the same: for in his Booke *de Principijs* he saith, that the seuenth month birth is brought into the world the 210. day, which opinion of his, *Auicen* the Prince of the Arabians followeth, *Fen. 21. lib. 21. chap. 2.* of the generation of the Embryo. But in his Booke *de septimestri partu* and in the very beginning he saith, that the seuenth month birth is borne within an 182. daies, and a part of a day, which also he repeateth in his Booke *de octimestri partu*, where he saith, that the seuenth month birth is fulfilled in halfe a yeere and a part of a day, that is to say, in a 182. daies and fiftene houres.

Some of the Interpreters, that they might auoide these snares, haue disallowed of his booke *De Septimestri Partu*, as if it were not *Hippocrates* owne, at least they boldly affirme that this place is corrupted. But we on the other side are as confident that it is truly Hippocraticall. For not onely *Galen* Commented vpon it, a few fragments of whose labour remaine to this day, but also the Lawyers of that time when Learning did most flourish at Rome and Athens, did translate this very sentence according as wee at this day read it into the number of their Sanctions. Wherefore these diuers not contrary places concerning the number of daies we will thus reconcile.

The Latitude of the seuenth month is very great, neither is the seuenth month birth alwayes brought into the world in one and the same day. There is a seuenth month beginning, and a seuenth month perfected. The beginning consisteth of an hundred and eighty daies & a part; the perfection consisteth of two hundred and ten daies. Before an hundred eighty two daies no Infant suruiueth, so that this is the first limit of the seuenth month. After two hundred & ten daies it is no more called a seuenth month but an eight month birth. The first births in the beginning of the seuenth month are indeede vitall, yet very languid and weak: the latter are

We thinke
Hip. month to
be Solary, con-
sisting of 30.
daies. Autho-
rities to proue
it.

How diuerse
Hip. is in com-
putation of
daies.

That Hip.
Booke *de Septi-
partu* is legiti-
mate.

Hip. interpre-
ted.

The utmost
time of the 7.
month birth.

very strong. Wherefore *Hippocrates* in the places before quoted expressed only the two extreme times of the seventh month birth, that is to say, the first and the last. The middle times he maketh no mention of, as of 204. dayes, &c. because they are sufficiently knowne by the nature of that extreme vnto which they approach the nearest. And this is not my interpretation of *Hippocrates*, but *Hippocrates* own. For, as in his Book *de Octimestri partu* he calleth those *Decimestres* not onely who accomplish ten whole months, but also that reach a few dayes within the tenth month: So those are called *Septimestres*, who beside six full months do attaine some dayes of the seventh. And yet more plainly in his Book *de Alimento* after hee hath described the *Septimestres*, *Octimestres*, *Nonimestres*, and *Decimestres parius*; at length he breaketh out into these words, *In these months are begotten or rather breeded more and fewer according vnto the whole and the parts*, that is, either in a part of the month, or in the whole & full month. And in his Booke *de Septimestri partu* he saith, that the five months which come betweene the first and the seventh must be numbred whole: but the first and the seventh it skilleth not much though they be imperfect.

The interme-
diate daies and
months are
onely perfect.

So in the computation of the Criticall dayes, those dayes which go before the *Crisis* must bee accounted whole; but the Criticall day it selfe wherein Nature endeauoureth the *Crisis* hath a great latitude; for a *Crisis* yea a happy and prosperous one, may fall out in the beginning, in the midst, or in the end of the seventh or the fourteenth dayes: wherefore those months which go before the birth, must bee all accounted wholl excepting the first. Againe the very month of the birth which is of the same nature for accompt with the Criticall day, hath two extremes and many intermediate times. In any of which if the Infant be borne hee may suruiue. And thus I thinke you may cleare your selfe out of the Thorne and intricate passages of months and dayes in the computation of the legitimate or illegitimate times of the birth.

QUEST. XXXI.

What are the vniuersall and particular Causes of the Birth.

Democritus.
The Sceptikes

Aristotle.

Hippocrates.

Heraclitus.

The vniuersall
causes of the
birth.

On the part of
the Infant.

Why the mola
& many mon-
sters live long
in the wombe.

Democritus a great Philosopher of his time, complaineth that the truth is drowned in a deepe well. The *Pyrron* or Scepticke Philosophers thinke that all things are vncertaine and that nothing can be determinately knowne. *Aristotle* the Father of the Schoole of Philosophers saith, that the certaine and Naturall causes of all things naturall are onely knowne to Philosophers; which before Philosophy it selfe was borne our admired master *Hippocrates*, in his Book *de Aëre, aquis & locis* hath thus expressed, *ἐν δὲ τῷ φύσει οὐδὲν γίνεται, οὐδὲν δὲ φύσει γίνεται, οὐδὲν δὲ φύσει γίνεται*, Nothing in Nature is done without Nature, that is, without a naturall cause. These causes if any man with *Heraclitus* shall deny, hee shall not onely entangle himselfe in a thousand Labyrinths of absurdities, but also forfeite all knowledge and assured demonstration; for to know, saith the Philosopher, is to vnderstand the causes of things; Seeing therefore the birth is a naturall action, and that the times thereof are very different, it shal not be amisse a little in this place to enlarge our selues in the disquisition of the causes thereof.

The Causes therefore of the birth are some of them vniuersall, others particular. The vniuersall causes are common not onely to man but also to all creatures; and some of them are on the part of the birth; others of the part of the Matrix or wombe; because the birth proceedeth from an equall contention of the birth, and the bearer. The cause on the part of the birth *Hippocrates* in his Book *de Natura pueri*, elegantly expresseth to be the defect of both sorts of aliment: Spirituous and Solid on this manner; *When the Infant becommeth larger and stronger, the Mother cannot supply it with fit and sufficient Aliment, which while it seeketh, with often kicking it breaketh the Membranes, and being vnloosed from those bandes yssueth forth.*

The Mola or moone calfe may be carried in the wombe many yeeres, because it is neyther nourished nor doth transpire; wherefore desiring neither aliment nor ayre, it is still retayned. There are ingendred oftentimes in the wombs of women, Monsters and Creatures of diuers kinds, as Serpens and Mould-warps, which because they haue litle bloud haue also litle heate, and being contented with transpiration alone doe lurke many yeeres in the corners of the wombe, neither would euer issue of their own accord vnlesse they were driven forth either by the contention of the womb or by the helpe of the Physician. The want therefore of nourishment is the first cause of the birth.

There

There is also another vniuersal cause on the part of the wombe: for the wombe hauing a determinate quantity and magnitude beyond which it cannot be extended, when once vpon the increase of the Infant it is come to that extent, it labourerth to lay downe the burthen whereby it is oppressed: and according hereto *Hippocrates* saith in his 1. Booke *de morbis mulierum* that abortments do happen when the wombe is too little, that is, when the Infant is so increased that it can be no longer contained in the wombe. *The wombe* saith he *hath peculiar dispositions, bred with it which cause abortment*, and among those dispositions hee accounteth the narrownesse thereof: wherefore the Infant seeking nourishment and the wombe not admitting further distention, do make the birth.

The vniuersal
cause of the
birth on the
part of the
wombe.
Hippocrates.

The particular causes doe belong onely to the birth of a man, because man onely among all creatures hath the times and spaces of gestation and birth very diuerse and different, of which differences the causes also are as different. First it is manifest that all brute beasts are at certaine times prouoked to Generation: as therefore the times of their coition are certaine: so also are the times wherein they bring forth; mankinde because at all times and seasons he is fitte for Generation, doeth at all seasons also bring forth his burthen.

The particular
causes of the
birth.

Now the limits of gestation and birth of the Infant are manifold and diuers; not on the part of the vniuersal agent, that is of Nature; for the power of Nature is the same in man and in beasts; the motion one and one established Law: but the variety comes from the diuersity of matter, which in a man vndergoeth manifold alterations more then in a beast; for brute beasts vse alwayes the same simple dyet, a man doth not onely vary in the matter but in the times of his repast. The other creatures after they haue conceived will no more admit the Male, which is not so with a womā, whence comes no smal alteration in the body of the Infant. The other creatures are not transported with passions, which how hurtfull they are vnto men, euery man hath too much experience in himselfe and *Plato* in *Charmide* elegantly recorded, writing, That all the mischiefes that happen to mens bodies proceed from the affections of the mind.

The diuersitie
is from the
matter.

The 1. cause.

The second

The third
Plato.

Some there are who referre the causes of the variety of the birth to the different Nature of the seed, some ripening sooner some later. To these we wil add the singular prouidence of nature for the conseruation of mankinde, which is the Finall cause: For being more carefull of man (whom *Pliny* calleth Natures darling) then of the brute beasts, she hath granted vnto him more times and limits, both of gestation and birth. The times of birth are the 7, 8, 9, 10, & 11. months: but why the 7. and 9. months are vitall, that is, why children suruiue who are borne in those months and not in the 8. this indeed is hard to be knowen.

The fourth.

The fifth.

Why the Infants
suruiue at 7.
months and
not at 8.
The opinion
of the *Pythagorians*.

The *Pythagorians*, *Geometricians*, *Astrologians*, & *Physitians* are of diuerse minds concerning this matter, and because it is an elegant controuersy and full of variety we will take liberty in this place to discusse them all.

The *Pythagorians* and *Arithmeticians* referre all things to number; for they make & ordaine a threefold order in things; of formes, figures, & numbers, among which, numbers are the chiefe: for in the whole Scripture we reade that all things are disposed in number, waight & measure.

Of Numbers some are equall some are vnequall; the equall numbers they call foeminine, the vnequall masculine; the first imperfect, diuisible and vnfruitfull; the latter perfect, fruitfull and indiuisible; and therefore say they these numbers haue the nature of a principle; for the equall number is generated of 2. vnequals; but an equall neuer generateth an vnequall. Furthermore among the vnequall numbers, the 7. hath the first place, whose maiesty and diuinity is so great, that the ancients tearmed it sacred and venerable. The *Magi* of the *Indians* and the wise Priests of the *Egyptians* called the 7. the number of the greater and the lesser world.

Differences of
Numbers.

The excellen-
cy of the num-
ber of 7.

Philo the Iew in his Booke *de mundi opificio* attributeth this prerogative to the 7. that it alone can neither generate nor be generated: of other numbers which are within 10. some doe generate but are not generated, as the number of one or the vnity; some are begotten but doe not beget, as the number of eight; some both beget and are begotten as the number of 4. onely 7. neither begetteth nor is begotten, and hence commeth the perfection and dignity thereof; for whatsoeuer neither begetteth nor is begotten that remaineth vnmoueable. Againe, the *Pythagorians* call the septenary number the rye or knotte of mans life, which *Tully* in *Scipio* his dreame acknowledgeth, where he saith, *That the 7. is the knot of all things.*

Harmonie

There is also in this number most harmony, as being the fountain of a pleasant *Diagramma*, because it containeth all the harmonies, *Diatessaron*, *Diapente*, *Diapason*; as also all proportions *Arithmetical*, *Geometrical* and *Musical*.

The Diuines call it the number of Perfection, because all things were perfected the 7. day. The number of Rest, because the 7. God rested from all his works. The number of Sanctification,

What the di-
uines say of the
number seuen.

tion, because it was commaunded to be sanctified or kept holy. Finally, the number of *Reuenge*, of *Repentance* and of *Beatitude*: whence it was that the Poet saith, *ô terque, quaterque Beati*, *O thrice and foure times happy*, i. seuen times happy.

Philo Iudæus and *Linus* an old Poet haue written many things in the commendation of this number of seuen. To omit that which some haue obserued, that there are seuen wonders of the world, 7. wise men among the ancients, seuen greater & lesser Triones in heauen, 7. circles wherewith the heauens is ingirt, seuen wandring starres or planets, seuen starres in the Beare, seuen starres of the *Pleiades*, seuen changes of the voyce, seuen physicall and naturall motions, seuen vowels among the Greekes, seuen ages; that the seuenth age shall be a golden age, seuen mouths of *Nilus*, seuen mettals, seuen liberall Arts, seuen windows in the head, seuen causes of all humane actions, seuen Cities that stroue for *Homer*, that the seuenth Sonne is able to cure the Kings Euill, and a seuenth Daughter if shee bee present quickneth a womans trauell, the hearbe Tormentil which hath 7. leaues resisteth all poysons. All these things I say we wittingly and willingly passe ouer, for it must be confessed that vnder the name of numbers there are many triuolous and superstitious toyes thrust vpon the world: I come to Philosophicall and Physicall demonstrations.

It is to be marked that the Physitians and Philosophers haue obserued how our life is dispensed by seuens.

The life of mā consisteth of seuens.

Hippocrates in his Booke *de principijs*, saith that the age of Man consisteth of the septenary number of daies: For many of them who in seuen dayes space doe neuer eate nor drinke, doe dye one of these dayes, aswell because the Gut called *Ieiunum* is contracted, as also because the stomacke in so long cessation of his office becommeth forgetfull afterward to do his duty.

The Seed of the man which within seuen houres after eiaculation returneth not backe, wee may bouldly pronounce is Conceiued: so the seuenth day after Conception, the first rudiments of all the spermatical parts doe appeare, and the geniture saith *Hippocrates*, *hath the seuenth day whatsoeuer the body ought to haue.*

The seuenth-month births are vitall not the eight, and the seuenth day after the birth the Infant casts the remainder of his Nauell: after twice seuen dayes he beginnes to mooue his eyes towards the light, after seuen times seuen he is able to mooue his head and eies euery way. The seuenth month he begins to breede his teeth, after twice seuen he is able to sit without feare of falling, after thrice seuen he begins to speake, after foure times seuen to goe, and after fife times seuen to leaue sucking.

The seuenth yeere he changeth his teeth, their third Generation beeing then made of most solid aliments as *Hippocrates* writeth in his Booke *de principijs*; at that time also his speech grows perfect, whence the Grecians doe make seuen vowelles. After twice seuen yeeres the signes of youth begin to breake out, in maidens the courses flow, breastes swell, and they are fitte for husbands. In men the voyce changeth, and they grow petulant by reason of the vigour of their naturall heate. After thrice seuen yeeres they grow towards their strength which remayneth constant the fourth, fift and the sixt seuens, and that age is called *virilis* and *constans ætas*, that is *Manhood*. The seuenth septenary is called *quadratus*, because then a man is euery way accomplished both in body and in mind.

Augustus Caesar to Caius.

The ninth is esteemed Climactericall and very dangerous, for it hath beene alwayes obserued (as *Aulus Gellius* noteth) that this time of a mans life is for the most part accompanied with some notable danger of the life, or griefe of the mind. And therefore we reade in the same Author, that *Augustus Caesar* congratulath his Nephew *Caius* concerning this Climactericall yeere on this manner. *All haile my pleasant Nephew Caius, whom belecue me, I do alwayes desire when thou art absent from me, but especially at such times as these my eyes do euen faile with looking for my Caius, yet wheresoeuer thou art this day. I hope that with good health and good chere thou dost celebrate this my 64. birth-day. For as thou seest we haue overcome the 63. yeere, the common Climactericall and dangerous yeere for old men.*

Psal. 90. 10.

The tenth Septenary which fulfilleth the seuentieth yere, is esteemed to be the limit of life, and so the Kingly Propheth singeth in the Psalme, *The dayes of a man are seuenti yeeres, beyond which all is labour and sorrow.* Wherefore all Septenary dayes and months and yeeres are especially to be considered, because in them there happen notable mutations.

Hence it is that *Ficinus* the Platonist giueth him Counsell that desireth to prolong his life, euery seuenth yeere to take counsell of an Astrologian and a Physitian of the Astrologian, that he may vnderstand what dangers and where do hang ouer his head; and of a Physitian, that

that by a prescript rule of dyet he may auoide the threatnings of the Starres & their maleficall influence.

Aristotle in his 7. Book *de historia Animalium* doth also acknowledge this prerogative of the number of seuen, because in euery septenary the greatest changes do vse to happen. *Galen* deli-nering the precepts of health, maketh the distinction of Ages according to seuens. It is not therefore without good warrant, that the *Pythagorians* call the septenary number the beginning or principle of all things: *Tully* the tie or knot of all things; and Physitians warranted by cer-taine experience, the King or Prince of the Decretory or Criticall daies. Wherefore the Py-thagorians and Arithmeticians doe therefrom conclude, that the 7. month birth is vitall be-cause it consisteth of an vnequall and most perfect number.

Pythagoras
and *Tully*.

And this *Hippocrates* in his Book *de Principijs* doth also acknowledge, for therefore he think-eth that Infants borne the 7. month do suruiue, because they haue attained a iust and full num-ber of seuens. And that the 8. month birth is not vitall, because it hath not fulfilled the ful De-cades of weeks. Moreouer in his Book *de Septi. partu* he writeth, that the conceptions, Abort-ments and Births of Infants are *Iudged*, as we speake, in the same times in which diseases haue their *iudgement or Crisis*. Now wee know that all diseases are most what *iudged* on vnequall daies, and that the septenary number is onely truly Criticall.

Hippocrates ~~ack-~~
knowledgeth
the power of
the septenary
number.

If it be objected, that the 10. month although it be equall and foeminine is yet for the birth vitall and legitimate, the *Pythagorians* will make answer, that ten is the perfection of all num-bers and containeth in it selfe all numbers of perfection. And this is the opinion of the Pytha-gorians and Arithmeticians of the causes of the 7. month and 8. months births, who conceite that all things are to be referred vnto the force of numbers.

That the 10.
number is
perfect.

For my own part I thinke with *Aristotle* in his *Metaphysicks*, that Number of it selfe hath no operative power, for so it is a quantity; but the nature of Number as it is the forme of time co-cluding all the works of Nature hath a strong efficacy. And this Nature & necessity as it were of Nature it selfe, *Hippocrates* in the end of his Book *de Principijs* promisseth to explaine.

What wee
thinke of
Numbers.

The Astrologians and Figure-flingers do referre the causes of the 7. month, 8. month, and 9. month births to the diuerse aspects of the Planets, for ouer euery month they think each planet hath predominance. *Saturne* ouer the first, who with his coldnes and drought reteyneth the li-iquid and moyst seed, and congeleth it as it were into a conception. Ouer the second *Iupiter*, who by his warmth and vitall heat causeth it to increase. Ouer the third *Mars*, who with his heate and drought maketh the members beginne to mooue. Ouer the fourth the *Sun*, who by the power of his wonderfull heate enlargeth all the passages. Ouer the fift *Venus*, who addeth grace & beauty to the Infant. Ouer the sixt *Mercury*, who polisheth and absolueth the Organs of motion. Ouer the 7. the *Moone*, who filleth the empty spaces and distances of the Fibres with flesh and fat, & with her moysture relaxeth the orifice of the womb that the birth may be easy. If therefore the Infant do the 7. month yssue furnished with all these endowments of the Planets, then is he vital and is likely to suruiue; but if being weak he be not able to loosen him-selfe from the sides of the wombe, then *Saturne* that maleficall Planet and aduersary to the principles of our life, returneth againe vpon him and so like a Tyrant holdeth the Infant priso-ner; or if in that month he come into the world he presently perisheth, as hauing his vitall heate nipped by the cold of that churlish Planet. Adde heere to, that the weake Infant is not able to beare or endure so sudden an alteration fro the *Moone* to *Saturne*, as if it were from the lowest staffe to the Ladder, because all sudden mutations are enemies to Nature.

The opinion
of the Astro-
logians,
Saturne,
Iupiter.

Mars,
Sol,
Venus,
Mercury,
Luna.

But if he overcome the eight month, then to *Saturne* succedeth *Iupiter* that beneficall Pla-net, by whose prosperous and healthfull aspect all the ill disposition that came by *Saturne* is frustrated and auoyded; wherefore the ninth month the Infant is borne vital and liuely, as also the tenth and the eleventh, because of the familiarity of *Mars* and *Sol* with the principles of our life. And this is the opinion of the Astrologers concerning the Causes of our birth, which is indeed elegant and maketh a faire shew, but is in the meane time full of Error as *Picus Miran-dula* hath proued in a Booke which he hath written against Astrologers. For how may it be, that *Saturne* should alwayes beare sway the 1. and 8. months, when as women may Conceive in any months of the yere, any day in the month or any houre in the day? Why do Hindes calue the eight month and their yong suruiue, as *Aristotle* writeth in his 6. Booke *De Natura Animalium*? *Pliny* is of opinion in the 5. chapter of his 7. Book *de Naturali Historia*: That only those children are vitall if they be borne the 7. month, who were conceived the day before or after the Full of the *Moone*, or in the New *Moone*. But all these are idle and addele imaginations of wanton braines.

The opinion
of the Astro-
logians con-
futed.

Pliny his idle
opinion.

The

The Geome-
tricians pro-
portions.

The Geometricians referre the Causes of the birth vnto the proportion of the Conforma-
tion and motion of the Infant. For (say they) there is a double proportion of the conformation
to the motion, and a trebble proportion of the motion to the birth, which proportion if the
Infant hold, then shall he attaine alie and liuely into the world. So the 7. month birth is vitall,
because it is formed the five and thirtieth, mooued the seuentieth, and borne the two hundred
and tenth day.

Hip. authority.

And this opinion may be confirmed by the authority of Hippocrates, for in the third section
of his 2. Book *Epidemion* he saith: *What soeuer is mooued in the seuenth day is perfected in the tri-
plicitie.* But Auicenna confuteth this opinion. For if onely the proportion betwixt the conforma-
tion and the motion of the Infant were the cause that he suruiued, then should he aswel suruiue

Auicenna.

the 8. as the 7. month, because they keepe the same proportion. For instance, Say that an In-
fant be formed the fortieth day, then shall he mooue the eightieth, and be borne the 240. And
in this birth the proportion is exquisitely held, because twice forty make eighty, & thrice eighty
two hundred and forty dayes. Now Hippocrates in his Booke *de Alimento* saith, that an Infant
borne at 240. daies (which all men vnderstand to be the eight-month birth) is and is not. But

Hip. explained.

the authority of Hippocrates may well stand with this opinion, for it is not his meaning that
this proportion is the cause of the life of the Infant, but simply & absolutely he saith, that there
is a certaine proportion betwixt the conformation, motion and Birth of the Infant, which no
man will deny.

The 5. opinion
of the Philo-
sophers and
Physicians.
The Lawes
of Nature are
certaine.

It remaineth now, that we acquaint you with the Philosophers and Physicians reasons why
the seuenth-month birth is vitall and not the eight. Nature although she be illiterate and vn-
taught, yet hath she constant Lawes which her selfe hath imposed vpon her selfe, definite also
and limited motions which she alwayes keepeth without inconstancy or mutability, vnlesse
she be hindred by some internall or externall principle. As therefore she neuer endeauoureth
any perfect Criticall euacuation vnlesse the humor bee before concocted and prepared:
So she neuer undertaketh a Legitimate birth till the Infant be perfected and absolued in all his
numbers. And as in crudity no good Crisis is to be hoped for according to Hippocrates: so be-
fore the Infant be perfected, the birth cannot be legitimate or vitall. For the birth saith Galen is
a kind of Crisis. Now before the seuenth-month the Infant is not perfected, and therefore be-
fore the seuenth month he cannot be borne a liue. But the seuenth month if hee bee strong he
breaketh the Membranes, maketh way for himselfe and suruiue because he is perfect, espe-
cially if it be a male child.

No vitall birth
before perfe-
ction.

The 8. month
birth why not
vitall.
Reason.

The eight-month although he be perfect he cannot suruiue, because he is not able to beare
two afflictions, one immediately succeeding in the necke of another. For in the seuenth
month hee laboureth sore, and repeateth his contention the eight, before his strength is resti-
shed.

Hippocrates
authority.

And this is Hippocrates opinion in the very beginning of his Book *de Olfimestri partu*, Con-
cerning the eight-month birth I am of this Iudgement, that it is impossible that the Infant should
beare two succeeding afflictions, and therefore those Infants doe not suruiue. For they are twice af-
flicted, because to the euils they suffered in the wombe the 7. months are added also the payne
in the birth the eight month.

Reason.

Again the 8. month birth is not vital, because it cometh after the birth day, which should
haue bene the 7. month, and before the birth day which is to be the 9. month. Whence wee
may gather that some ill accident hath betided the Infant or the mother which hindred the
birth the 7. month and preuented the ninth.

And hitherto belongeth that golden sentence of our admired master Hippocrates in the 8.
Section of his 6. Book *Epidemion*. *If nothing happen within the prescript time of the birth, what-
soeuer is borne shall suruiue.*

Why a wo-
man goeth not
about 11.
months.

But now why a woman doth not beare her burthen beyond the 10. and the 11. months,
Hippocrates in his Book *de Natur. pueri* referreth the cause to the want of Aliment. Now the
Aliment faileth as well because a great part of the blood flowes back vnto the Pappes for the
generation of Milke, as also because the Infant is nourished only with pure and sweete blood
which the mother can no longer in sufficient quantity supply vnto him. Neither is that to bee
passed ouer with silence which Hippocrates obserued in the Book before named, to wit, that in
some women the Aliment faileth sooner, in some later. Those which are not accustomed to
bring forth, haue lesse Aliment then others for their Infants, because the blood is not accust-
omed to turne his course toward the womb. Again, those women who haue lesse store of their
courses and of Milke, their Aliment faileth the soonest.

What women
defraud their
Infants soonest

It is also worth our obseruation that large and great creatures do carry their burthens the longest, because they doe not so soone attaine the perfection of their increment or growth: So an Elephant bringeth not forth before the second yeere after her conception, but house-doues breed euery month.

Why great creatures carry their yong long.

Man being of all Creatures the most perfect, the most wise, the most temperate and as it were the measure of all others, hath also moderate times of gestation, that is, the 7. and the 9. months if Nature be not interrupted or preuented.

QUEST. XXXII.

Whether in a desperate birth the *Cesarian* Section be to be attempted.

Aristotle in his 7. Booke *de Natura Animalium*, sayth that among all Creatures a Womans trauell is most laborious and difficult, as well because she leadeth a soft and sedentary life, as for that a mans Braine is the largest and so his head great especially, as long as he is in his mothers wombe; now the head vseth to come forward in the birth. This birth as saith *Galen* in the eight Chapter of his fifteenth Booke *De usu partium*, exceedeth all admiration, for the mouth or orifice of the womb, which all the time of the gestation is so closed that a needles point cannot passe into it; in the birth is so enlarged that the Infant yssueth out thereat.

Why the birth of man is most difficult.

A miracle of Nature in the birth.

But there are many obstacles which intercept the passage of the Infant by the orifice and necke of the wombe, as the thicknesse and magnitude of the Infant, or natural straitnesse of the inward orifice and of the neck; a distortion, inflammation, some tumor against nature, a fleshie Caruncle, a scarre, or the faulty conformation of the share-bones. For oftentimes in the inner part of the share-bone there is a sharp proesse which intercludeth the passage of the Infant vnto the birth place, and then there is no hope that the woman can be deliuered: Wherefore either the Infant must perish or the mother, or both together. In this so hard and desperate an extremity, the question is what may be attempted? we answer. If the mother bee dead and the child yet liuing, then presently without any delay the wombe of the mother must be ript open. And those children that are thus taken forth are called *Cesares*, or *Casones* from the cutting of the mothers wombe, from whence the *Cesars* had their names. After this manner as *Pliny* reporteth in the 9. Chapter of the 7. Book of his Naturall History, was *Scipio Africanus* the elder, *Julius Cesar* and *Manilius* borne.

What things hinder the outgate of the Infant.

The wombe must be presently opened if the mother be dead.

But if the mother be yet aliue, and the Infant by no other meanes can safely bee brought forth, the same section or opening of the wombe may be administred; for common experience and the authority of ancient Physitians doe assure vs that the wounds of the muscles of the lower belly and of the *Peritonaeum* or rim are not mortall.

Though the mother liue, yet this section may be attempted.

Hippocrates in the 3. Section of his 6. Book *Epidemion*, commaundeth vs to cutte our Dropsy patients instantly: now this Section for the Dropsy is a wounding of the *Epigastrium* or lower belly & the *Peritonaeum*; as for the womb it selfe *Paulus Aegineta* teacheth vs that the wounds thereof are not mortall. It appeareth vnto vs, saith he, that though the whole *Matrix* bee taken away, the woman will ordinarily suruiue.

Hippocrates *Paulus*.

Concerning this *Cesarian* section, *Franciscus Rossetus* the French Kings Physitian hath set forth an elegant Booke so beautified with Histories and abounding with good arguments, that we should abuse our time and your patience to transcribe them in this place: wherefore we remitte those who desire further satisfaction heerein to the learned Author.

Franciscus Rosset.

QUEST. XXXIII.

Whether in the Birth the Share and Haunch-bones doe part asunder.



He works of Nature in the conformation, life and nourishment of the Infant are indeede full of admiration, but her last endeuour in the birth thereof is indeed the crowne of all the rest, as that which exceedeth all admiration. For the orifice of the wombe which after the first apprehension and conception of the seed was so exquisitely closed that it wil not admit the point of a Probe: now that the Infant

The wonderfull indeuour of nature in the birth.

fant with turning, kicking and breaking of the membranes prepareth toward his enlargement, it is so relaxed as if it were a gate wide open.

But because Nature is so wise and provident that she undertaketh nothing without due preparation, therefore in the last months of gestation shee lyneth the inner surface of the orifice with a slimy and mucous humor, which thereupon becomming moyst and soft doth more easily distend or enlarge it selfe without feare of laceration or tearing.

Now whereas the wombe is contained within the capacity of the hanch-bones, & is walled about on the fore-side with the share-bones, on the backe-side with the holy and rump-bones, and on either side with the hanches, whereof some are ioyned together with a fast and immovable articulation, other by the mediation of a cartilage or gristle: whether in the birth there be a divulsion or separation of these bones, that now is the question we have in hand.

That the bones
are parted in
the birth.
Authorities.
Hippocrates,
Auicenn.

Some learned men are of opinion that the share-bones and the haunch-bones are seuered, which also may bee confirmed by the authorities of many right learned men and by reasons which carry with them a faire shew of truth. *Hippocrates* in the end of his Booke *de Natura pueri* wrote on this manner. *In the very birth the whole body is as it were vpon the racke, but especially the loynes and the hanches, for their Coxendices are distracted & parted asunder.* And *Auicenn* in his 3. Booke, *Fen. 2. 1. Tractat. 1. Cap. 2.* saith. *When the Infant is borne the wombe is opened with such an apertion as cannot bee made in any other place, and it is necessary that some iunctures must be separated, which are so sustained by the helpe of God so disposing and preparing, and afterward doe returne to their naturall continuation; and this action of all the works of Nature is the strongest and most forcible.* *Rabbi Zoar* vpon the 1. of Exodus. *Thou shalt not easily find any thing in the whole administration of Nature more to be admired then that distraction of the share-bones in womens trauell, which indeed is done by the providence of God to whom Nature is but a seruicable hand-maid, for otherwise no strength almost is able to separate them. The like also we see in the shooting of Stags hornes which euery yeere fall and grow againe.*

Rab. Zoar.

Pinaus opinio.
His first rea-
son.

Seuerinus Pinaus in his Physiologicall and Anatomical work is of the same opinion, which also he strengtheneth by some reasons. Before the 7. month, saith he, the womb & with it the Infant doth alwaies ascend; after the 7. month he descendeth and prepareth himselfe toward his enlargement. At that time the priuities of the woman with childe are moystned with a mucous slime, and the parts are dilated and relaxed, with which humour also by degrees the gristles of the share-bones are inebriated, that in the birth they might be the more laxe. Furthermore almost al the gristles of the body in progresse of time doe dry into a bony substance as may be seene in the chinne; but the cartilage which tyeth together the share-bones remaineth gristly to the end of our life, neither euer becommeth bony because in the birth it is to be distended and enlarged. Moreouer if you well consider virgins of 16. or 18. yeeres old, and againe take notice of them after they haue conceiued, thou shalt perceiue that their hanches are distended, their *Hypogastrium* enlarged and their buttockes become broader, especially when they are neere the time of their deliuerance: and therefore it followeth that those parts are dilated. Moreouer, those who haue liued long virgins haue harder trauels then yonger wenches, because their gristles in these places are more dried and lesse relaxed.

The second

The third

The fourth

The fifth.

A story.

Finally, such as neuer haue conceiued haue thinner gristles, and such as haue ofteneft conceiued haue them most thicke and are broadest in the hanches. Wherefore in the birth the share-bones are parted asunder one from another, and the hanch-bones from the *Os sacrum* or holy bone. And for the confirmation of this opinion, he telleth a Story of a woman who was new deliuered and shortly hanged, whose share-bones were so distracted that one of the *Coxa* was lifted vp and the other depressed.

Our opinion
that the bones
cannot be se-
uered.

For my owne part that I may freely speake what I thinke, I do not think that these bones in the birth can be vnioined, for they are so fast knit together that no violence can seuer them. And if they bee separated asunder how shall they be againe coupled? with what Cement or Glue shall they be vnited? For a new Synchondrosis or articulation by the mediation of a cartilage cannot be made. If you say with *Hippocrates* that they chinke a little, I will not be against it. Also that the gristly end of the holy-bone, which they call *Coccyx* or the rumpe, may bee torally retracted and so giue way to the Infant that there should bee a greater space left for his out-gate, that I can well beleue. As for *Pinaus* arguments they may thus be in order answered. It is indeed said and said truly, that in the last months of Gestation the inner orifice of the wombe is lined with a slimy humor, proceeding eyther from the vrine vessels, or from the humours sweating through the Membranes, or otherwise from the reliques of the Infant; but that humor say wee cannot attaine vnto the Share-bones or to the Cartilages betweene them,

*Pinaus argu-
ments answe-
red.*
To the first.

them, neither yet vnto the hanch-bones; because the wombe doth not immediately touch the share-bones; for betwixt the wombe and the bones lyeth the bladder lurking betwene the two coates of the *Peritonaeum*, and compassed round about with the *Peritonaeum* as it were with a purse or Satchell.

And whereas he saith, that the Cartilage which knitteth together the share-bones neuer becometh bony but alwayes remaineth gristly that it might be relaxed in the birth; it is but a slight reason; for neither in men is that gristle euer found to be bony. In young wenches after they haue conceiued, their hanches are distended and the capacity becometh larger, and that because at that time all the parts of their bodies do grow and the heate which before was well neere choaked with the aboundance of humors beginneth to shine forth and gather strength. Elder Maidens hauing conceiued haue harder trauelles then yonger, not because the gristles are drier but because their wombs are drier; for those that vse to conceiue and beare children haue moister wombes, larger vessels and all the capacities more large and ample, and therefore their trauell is more easy. One History doth nothing moue vs, for we haue seene many who haue perished in the very brunt of their trauell in whom there hath appeareth no such matter, and we obserue that women in their trauels do more complaine of the paine of their *Os sacrum* and rump, then of the region of the share-bones.

And thus are we come to an end of our long Discourse of the History of the Infant and the Controuersies thereto belonging, wherein how we haue acquitted our selues it resteth in thee gentle Reader to iudge; this one thing we know, that we haue wrought out our way through many difficulties, which if they shall prooue as profitable and pleasant vnto thee as they haue beene to vs difficult to ouercome, we haue abundant recompence.

Now wee proceede in our entended iourney to the Chest, wherein what Admirable rarieties Nature hath bestowed, wee referre thee to our Discourse to be satisfied.

To the second

To the third.

To the fourth

To the fifth.

The end of the Controuersies of the Fifth Booke.





Of the Middle Region, called the Chest or the Thorax, which conteyneth the Vitall parts, to which also we will referre the Necke with the Weazon.

THE SIXTH BOOKE.

The Preface.

HAving thus absolued the Lower Region with the parts thereof as well Nutritiue as Generative, together with the History of the Infant; it followeth that we ascend by the staires of the ridge to the middle Belly, wherein as in a curious Cabinet Nature hath locked vp the vitall Instruments and wheelles whereby the Watch of our life is perpetually mooued from the first houre to the last minute, by so iust a counterpoise as no Art of man could euer attaine vnto, albeit some rare Engineers haue gone very farre in imitation thereof. If we should enter into the causes of this perpetual motion, as it would be very hard to find them out, so would it spend much time to enquire after them. The highest cause is the hand of God, who hath prepared the Pullies, hung on the weights, and gouernes and winds vp the Chime at his own good pleasure. For if the Philosopher were not able (though he were nere of counsel to Nature) to discern with the sharp edge of his incomparable capacity the reason of the reciprocal cbbing and flowing of the Sea: how shall we be able to yeelde a reason of the Dilatation and Contraction of the Heart? Notwithstanding it is commonly conceiued that the most immediate cause is the auoiding of Vacuity that Arch-enemy of Nature. For the Faculty of pulsation although it be potentially in the Heart of the Infant in the Mothers wombe, yet it is not drawn into act till the Chest distending it selfe doth draw in the aire whereof that Vitall spirit is made, about whose generation that Pulsatiue vertue is wholly occupied. As for the motion of the arteries, we conceiue that they follow the motion of the heart, like as a Lute lying by another that is played vpon, will represent or returne the distinct Tune thereof.

I might heere enter into a large discourse of the excellency of the Heart; how in this Little world, it is like the Sun in the Great world; how it continually supplieth the expence of Vitall spirits; how it quickneth and strengthneth the Naturall heate of the whole body; how it is an Embleme of an excellent Magistrate; how the Lungs as fresh Fannes do temper the flaming heate of the hearts furnace, & how as bellows they kindle the same againe. For albeit this Sun of the body can neuer be truly eclipsed, this Geniall fire neuer extinguished without the dissolution of the *indivindum*; yet we see in many cold diseases of the braine and malignant exhalations from the womb, that to our sense this sparke of Sacred fire is deaded and put out, which notwithstanding by the helpe of the Lungs is afterward blowne vp into a luculent flame.

Beside the Organs of life, there belongeth also to this Region another no lesse admirable instrument of Nature, whereby the voice is so diuersified, that vpon the ground thereof that noble Science of Musicke hath beene from the beginning and still is infinitely propagated and yet the end or perfection thereof not attained vnto. But why do I go about in this place to exemplifie the administrations of Nature in this middle Region? considering that to say a little is derogatory from the worth of the argument; to say much were heere in vaine, seeing the following Discourse is purposely addressed for the Readers satisfaction therein.

CHAP.

CHAP. I.

Of the Thorax or Chest, and the Division of it.

THe middle belly is called *θώραξ*, of a word which signifieth to leap or dance, because in it the heart continually mooueth from the ingate to the outgate of life. It is comprehended by the ribs, or rather circumscribed by Ribs and Patell bones, and is separated from the lower Belly by the Midriffe or *Diaphragma*, and it is the seate or conceptacle of the vitall Faculty which harboureth especially in the heart, for whose sake this Chest or *Thorax* was made; the habitation of the breathing parts, and the shop wherein the voice is framed; and for this cause it is called of *Hippocrates* *χώρας testudo*, a Citterne or Crowd, because the sound of it maketh Musicke. It is placed betweene the vpper and lower bellies, that the Natiue heate which resideth in the Heart may be equally communicated to all the parts.

The Chest.
How it is limited.

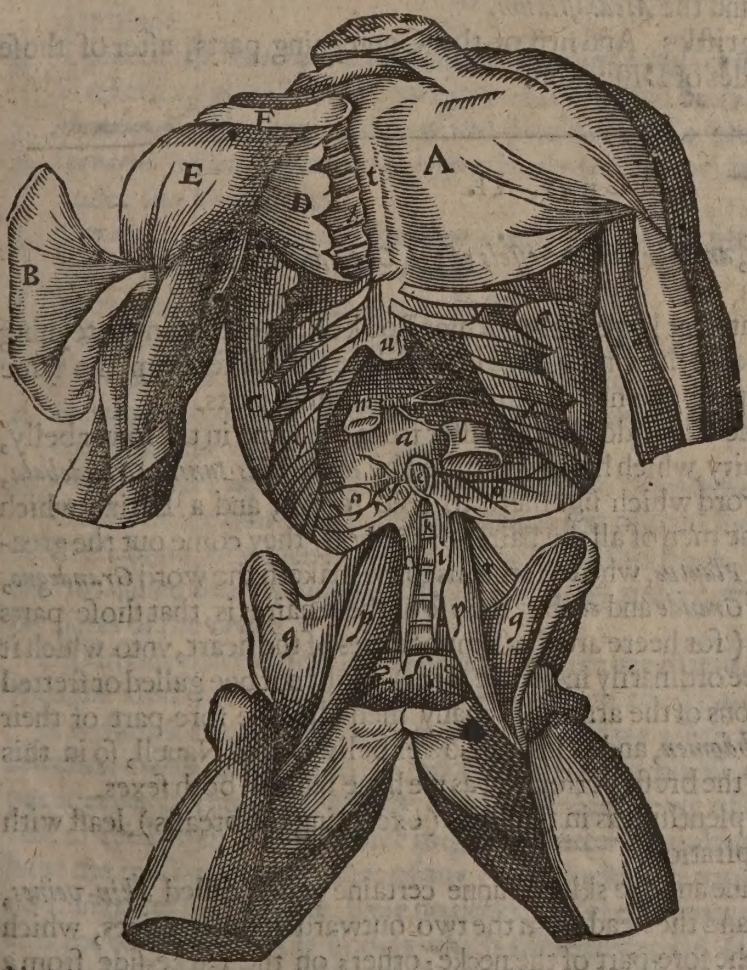
The Chest
was made for
the heart.
Compared to
a Crowd.

The Figure of it is very capacious, being long and round like an Egge, whose magnitude may be guessed by the compasse it carrieth without. Before and behinde it is wider in man (saith *Aristotle* 2. *Hist. Anim.* 1.) then in other creatures; before, that there might be sufficient space for the Heart and Lungs to mooue and spred themselves in, both for the voyce and for respiration saith *Galen* in the 6. Chap. of his 13. Booke *de usu partium*, that we might haue abundance of spirits, for that in it the sprightfull blood is laboured of blood and aer, and the voice also is to be formed of the aer. Behind it is wide, that a man may ly at ease vpon his backe; in other creatures it is fashioned like the Keele of a Shippe; betwixt their fore feete in foure-footed Beasts for their better footmanthip; in Birdes for the nimbler

The Figure of
it.

Table 1. sheweth the body when all the bowels are taken out of the Lower Belly, and reclined backward, that the Scituation of the Midriffe might better be discerned, it sheweth also the other part of the Chest as yet covered.

TABVLA I.



- a The Midriffe in his seate.
- c the hole of the great artery cut open.
- b, i. Two fleshy originals of the Midriffe.
- k. The diuision of the Midriffe where it transmitteth the Artery.
- l. The leste perforation of the Midriffe giuing way to the gullet.
- m. The hole of the Midriffe through which the hollow veine ascendeth.
- n. The veine called *Phrenica*.
- o. The artery called *Phrenica*.
- pp. The sixt paire of Muscles of the thigh, called *Isas*.
- qq. The seauenth paire of Muscles of the thigh, which fil the cauity of the hanchbones.
- r. The fift Muscle of the backe.
- s. The Holy bone, together with some nerues arising out of the marrow thereof.
- t. The brest bone.
- u. The brest blade.
- xx The ribs.
- yy The intercostall Muscles.
- AB. The pectorall Muscle, or the first Muscle of the arme in his proper seate at *a*, the same separated as farre as his implantation at *B*.
- CC The Muscle called *Serratus maior* or the second Muscle of the Chest.
- D. *Serratus minor*, or the first Muscle of the Shoulder blade.
- E. The Muscle called *Deltoides* or *Epo-*
mus, the second Muscle of the arme,

his originall is at *t*. E. The *Clavicula* or Celler bone.

Hh

motion

motion of their wings when they flye. If it had beene otherwise framed in men (saith *Galen* in the 11. chapter of his 13. Book *de usu partium*) it would haue hindred the actions of their armes, and in Beasts it would not haue suffered their fore-bowes to haue beene so close brought to their chest, which would haue hindred them much in their gate.

The substance
and structure.

The substance of it is neyther altogether bony as the scull is, for then it could not haue beene mooued, nor altogether fleshy as the Lower belly, for then the Muscles would haue falne vpon the heart and the Lungs euen of their owne accord: wherefore that both there might be a space within the motion, and also all the whole frame of the instrument might be mooued together, the Muscles and the bones are set as it were by courses one beside another. For because the heart, one of the principall bowels, was to be seated in this Chest, it needed a more safe and secure muniment or defence, and therefore it is walled about with bones: but because the exceeding great heate of the heart stood in neede of much colde of aer, by which as by a fan it might be ventilated and preserued, it was necessary that the chest should be moueable, that in the dilatation of it aer being drawne into the Lungs might refresh the heart, and in the contraction the sooty vapors might bee expelled. Wherefore it was necessary that it should be composed of many bones, which because they should mutually follow the motion one of another, it was requisite also that they should bee ioyned together with some pliable substance, such as is a Cartilage or gristle.

The reasons of
it.

How rightly
called the
middle belly.

The Chest therefore is moued with Muscles and made vp and compacted with bones, and therefore is rightly called the Middle venter, not onely because of his scituation, but also by reason of his substance, neither wholly bony as the head, nor wholly fleshy as the lower Venter.

The Division
of the Chest.

The whole *Thorax* or Chest is diuided into a fore-part, which is called *σῆθος* or *sepeus pectus*, commonly the brest; the side parts called *πλαγὰς*, *Latera* the Sides, and the back part called *ὄπισθεν* or *μετὰ στήθεσιν* *Dorsum* the Backe, all which appeare in this precedent Table.

The parts of it

The parts of this Chest are some conteyning, some conteyned. The conteyning parts are common or proper, the Common are the Skin-scarfe or Cuticle, the Skin, the Fat: the Fleishy pannicle, and the Membrane of the Muscles. The Proper are soft or hard, the soft are fleshy, as the Muscles and the breasts, (of which we haue spoken before as rather belonging to the lower Venter, though for ornament and commodious vse they haue their seat here) or Membranous, as the *Pleura* and the *Mediastinum*.

The hard parts are bones or gristles, And first of the Conteyning parts, after of those conteyned, according to the order of Dissection.

CHAP. II.

Of the Skin, the Fat, and the skinned vessels of the Chest and the Necke.

How the com-
mon inuesting
parts differ
from the same
in other parts.
The Haires of
the arme-pits.

BEcause we haue entreated at large in the former Book of the common conteyning parts, we will onely heere shew how farre in this place they differ from the same in other parts, and so passe on vnto the Proper Conteyning parts.

Their vse.

The Scarfe-skin and skin of the Chest, do heerein differ from the same in the lower belly, because in the arme-pits it is hairy, which haires are called by *Hadrianus Iunius*, *Grande bala*, I thinke coyned of a Greeke word which signifieth to send forth, and a Latine which signifieth great (because in some men of all the haires of the body they come out the greatest and most bristlie) imitating *Plautus*, who to serue his turne maketh the word *Grande gro*, to stalker on with wide steps, of *Grande* and *eo*. But the vse of these haires is, that those parts which sweate soonest and most (for heere are the Emunctories of the heart, vnto which it sendeth his excrements as we see ordinarily in plague fores) might not bee galled or fretted with the often and strong motions of the armes. In many men also the fore-part of their Chest is more hairy then the *Abdomen*, and as in the Lower belly is the Nauell, so in this middle belly are the nipples of the breasts perforated as we haue saide in both sexes.

The fat in this place is not so plentifull as in the belly (excepting the breasts) least with his waight it should hinder respiration.

Betwixt the fleshy membrane and the skinned runne certaine vessels called *Skin-veines*, some by the sides of the necke and the head from the two outward iugular veines, which with their furcles runne along the fore-part of the necke; others on the backe-side from a

branche

branche which the shoulder veine called *humeraria* sendeth vpwrd, others are disperfed through the foreparts of the Chest, to wit, two coming from the *Axillary* veines, one of which is a branche of the *Axillary* veine, the other of the *humeraria*, like as through the back are difseminated certaine small branches from the same veines. The Arteries which come hither are exceeding small and capillary: Finally, there are certaine nerues sent from the nerues that ly lower vnder the muskles and the skinne, but two more notable then the rest which meete about the teates, which are the cause of their so exquisite sence.

Arteries.
Nerues.

CHAP. III.

Of the muscles of the middle belly and of the parts of the necke.

THe Muscles of the middle venter are double, for either they lye vpon the ribbes or are scituated betweene them, yet all of them are not made onely for the motion of the Chest; for albeit they arise from the Chest, yet they moue either the armes or the shoullder blades or the backe or else the Chest it selfe, and such are called the *proper muscles of the Chest*, and these muscles are placed without or within: those that are seated without are on the fore-part or on the backe-part.

On the fore-part there are three on either side.

1. *Pectoralis*, the pectorall, and it is the first muscle of the arme, which is broad and large and seated vnder the Pappes.
2. *Serratus maior*, the greater saw, the second muscle of the Chest which lyeth vpon the ribbs, and to them is inserted as it were with fingers, whence it hath the name of the saw, and occupieth especially the side.
3. *Serratus minor*, the lesser saw, or the first muscle of the shoullder-blade, it is triangular, and lieth vnder the pectorall muscle.

Muscles on the
fore-side of the
chest.

On the back part there are ten on either side.

1. *Cucullaris* or the *Munks-hood* the greater part of the second muscle of the *scapula* or shoullder blade.
2. A part of the third muscle of the arme called *Latissimus* or the broadest muscle, because it taketh vp almost all the back-part of the lower belly.
3. *Rhomboydes*, the third muscle of the shoullder-blade scituated vnder the *Munks-hood*.
4. *Serratus Posticus superior*, the upper hinder saw, or the fourth Muscle of the Chest lying vnder the *Rhomboides*.
5. *Serratus posticus interior*, the lower hinder saw, or the fift muscle of the Chest, scituated vnder the muscle called *Latissimus*.
6. *Sacrolumbus*, or the sixt of the chest.
7. *Longissimus*, the long muscle, the 2. of the backe.
8. *Semi-spinatus*, the fourth muscle of the backe.
9. *Splenij pars inferior*, the lower part of the *splenium* or of the first muscle of the head placed vnder the upper hinder saw.
10. *Complexi pars inferior*, the lower part of the *Complexus*, or the 2. muscle of the head.

Muscles on
the back-side
of the chest.

On the inside there is one triangular, the sixt of the Chest; lying vnder the lower part of the brest-bone, of which in the 19. Chapter of this Book. Those muscles that are betweene the ribs called *intercostales* we shall intreat of by and by, when wee haue numbred vnto you the parts of the necke.

On the inside.

I do in this place describe the necke, because the chiefe parts therein contayned belong vnto the vitall parts, as the muscles of the voyce, the weazon, the *larynx* and such like.

It is therefore called *Collum à colendo*, because we vse to adorne this part with chaines and iewelles. *Galen* called it *ραχυνος* because of the sharpnesse of the bones of it. It is a middle part betweene the Chest and the head made for the vse of the Chest and the Lungs; long that in the length of it the voice might be better modulated or tuned, and therefore birds haue the most variety of tunes of any vnreasonable creatures, but fishes because they haue no Lungs and so are mute, haue no necks, but al creatures that haue Lungs haue also necks. It is round because of the bodies which are seated in it. The parts contayned in it are the iugular veins external and internal: the Arteries called *Carotides*, nerues of the sixt paire and

The necke.

The figure.
The parts con-
tained.
Concerning
the muscles of
it.

the recurrent nerues : all which are placed on the sides, but before, the weazon called *aspera arteria* or the sharpe artery and the gullet called *oesophagus* of which we haue spoken before. The muscles which are in the necke are many; some moue the necke it selfe, some the *larynx* or throtle, some the bone *Hyois*, some the tongue, some the head, the lower Iaw and the shoulder blades. Of these some are scituated before some behinde. Behind those that follow which we will name as they lye each vpon other.

1. *Cucullaris pars superior*, the vpper patt of the *Munks-hood* or the second muscle of the shoul-der blade, descending from the *occipitium* or nowle of the head.
2. *Leuator*. The fourth of the shoulder blade seated more toward the sides.
3. *Splenius*, The first muscle of the head.
4. *Complexus*, The second of the head.
5. *Recti maiores*, The third paire of the head.
6. *Obliqui superiores*, The fift paire of the head.
7. *Obliqui inferiores*, The sixt paire of the head.
8. *Recti minores*, The fourth paire of the head which lie vnder the second muscle of the back.
9. *Transuersalis*, The third of the necke.
10. *Scalenus*, The second of the necke, it lieth on the side from the first rib into the necke.

Before; these, beside those which grow to the iaw and are vnder the chin.

1. *Quadratus seu Platysma myodes*, The first muscle common to the cheeks and the lips.
2. *Mastoydes*, The seuenth of the head, from the pattell bone to the sides of the head.
3. *Sternohyoidei*, The first paire of the bone *Hyois*, which lye vpon the wezon.
4. *Coracohyoidei*, The fourth paire of the bone *Hyois* seated at the sides.
5. *Oesophagii*, The third paire of the common muscles of the *Larynx* or throtle.
6. *Longi duo*, The first muscles of the necke.

But we returne vnto the Chest, and first to the *Intercostal* muscles as being proper only to the Chest, and therefore we will here follow their description more accuratly in this place.

CHAP. IV.

Of the Muscles betweene the Ribbes called *Intercostales*.

The *Intercostal* muscles.

Their number.

THe muscles which are wouen between the ribs and do fill vp the distances between them are called *μεσολαυροι Intercostales*. Gal. in his Book *de usu respirationis*, accounts them according to the 11. ribs 22. otherwhere thrice so many and two ouer, that is 68. as saith *Archangelus*, but he himselfe reckons them 34. we wil account them 44. For because there are on either side 11. distances, and in euery distance there are 2. muscles, there are on either side 22. Of which some are external [tab. 1. 77] which are 11. & so many internal or within. These are fleshy and narrow but long, according to the portion of the distances; their fibres are carried obliquely from one ribbe to another in a contrary position, so that those of the inward and outward muscles lying one vpon another doe mutually intersect themselves in the manner of a Saint Andrewes crosse, or this letter X. The outward of these muscles or the superior are carried from the lower parts of the vpper end of the ribbes to the vpper parts of the lower end of the ribbes: for they beginne in the backe part from the transuerse proccesses of the rack-bones to which the ribbes are annexed, and passe with their fibres obliquely forward all along the bought of the ribs to the beginning of the cartilages; (where the bony parts of the ribbes doe end) and are ioyned to the breast-bone; they want tendons because of the narrownes of the place, neither do they reach thorough the distances of the gristles.

The interior or inward muscles quite contrary are carried from the vpper part of the lower ends of the ribbes to the lower part of the vpper end of the ribs, but do not beginne from the proccesses of the rack-bones, but from that part in which the ribs are bent, and run forward with their oblique ascendent fibres, and fall vpon the distances of the ribs as well where they are bony as where they are gristly, and keeping alwaies the same series or course of fibres passe onto the very bones of the brest, yet so, that in the distaces of the gristles they are lifted vp a little to the outward face of the Distance, and so supply the places of the exterior where they are defectiue or wanting. And this is the cause why the Fibres in the di-

Diuers fibres
one vnder an
other.

stances

ſtances of the griſtles do appeare diuerſe from thoſe in the diſtances of the ribs themſelues. And if you take off theſe Fibres betweene the griſtles, you ſhall finde alſo others vnder them of another poſition, which are the Fibres of the ſixt Muſcle of the cheſt which is called the triangular Muſcle.

From the vndue diſtinction of theſe Fibres, ſome haue made 68. intercoſtall Muſcles, when indeede they are but 44. reckoning thoſe differing Muſcles which are betwixt the bony parts of the ribs [Tab. 2. fig. 1, C C] from thoſe that are betweene their griſtly parts. [Tab. 2. fig. 1, D D] And whereas the diſtances of the ribs are eleuen, ſix of the true ribs and five of the baſtard ribs; they think, that there are foure in euery diſtance of the two ribs, two where they are bony, and two where they are griſtly, and thoſe internall and externall, but in euery diſtance of the baſtard ribbes they will haue but two, one externall and another internall.

Auiſen.

How Auiſen and Columbus were deceiued.

But we muſt further obſerue, that the outwarde Muſcles, by how much they ariſe neerer to the rack-bones, by ſomuch the ſooner do they determine in the fore-parts of the ribs; ſo againe the inward, by how much the later they ariſe from the bent of the rib, by ſo much do they come ſhort of the breſt-bone.

A note concerning the originall & end of theſe Muſcles.

Why they are obliquely placed and interſect themſelues *Varolius* hath elegantly ſhewed; prouing that it was ſo neceſſary for the dilatation and conſtriction of the cheſt. For becauſe the diſtance which is betweene one rib and another, was not answerable to the length of the Muſcles required neceſſarily for the dilatation and conſtriction of the Cheſt, therefore they are diſpoſed betweene the ribs not with right Fibres (and euen *Galen* intimated ſo much in the 23. Chapter of his Booke *De Diſſectione Muſculorum*, but was not vnderſtood, at leaſt not obſerued by the Ancients) but with oblique; and that this helpeth dilatation we may euidently ſee, becauſe euery thing retcheth more being drawn obliquely, then if it be drawn right out, as Cloth, Leather and ſuch like, which we call drawing Biace. For conſtriction alſo it is as fit, becauſe the Muſcle is contracted more or leſſe according as it is greater or leſſer. Wherefore, if they had had right Fibres, they muſt needs haue beene ſhort and ſo their contraction much ſtraightned, neither could they haue ſufficiently bound in the Cheſt.

Why theſe Muſcles are obliquely placed of neceſſity.

How they help dilatation.

How they help conſtriction.

Moreouer, becauſe euery Muſcle drawes according to the courſe of his Fibres, therefore leaſt the ribs in their oblique motion ſhould ioyn cloſe together, the intercoſtall Muſcles are framed double (a thing vnknewne to the Ancients) that with their contrary fibres they might interſect themſelues. For when two oppoſite bodies do together drawe obliquely, there reſulteth by their oppoſition one ſtraight and direct motion.

Why theſe Muſcles are double.

The Uſe of theſe Muſcles (as moſt Anatomists haue recorded) is to conſtringe and dilate the Cheſt. Of the exterior in expiration to beare down the ribs together, and ſo to ſtreighten the Cheſt; of the interiour to diſtend and ſeparate the ribs, and ſo to enlarge the cavity of the Cheſt for inſpiration. But when *Galen* ſaith in the 15. Chapter of the fiſt Booke *de uſu partium*. That the intercoſtall Muſcles helpe the Midriffe, that they might draw the Cheſt inward, it is to be vnderſtood not that they further the proper motion of the Midriffe, but that they moue the ribs inward; which is their proper function. But what kinde of motion is this? For either they bring one ribbe to another or ſeuere one rib from another, or they liſt vp the ribs or preſſe them downe. The two former motions they performe not; for there is no uſe of any ſuch motions, neither can any of them of it ſelfe as a voluntary inſtrument dilate the place wherein it is, or ſeparate one rib from another; neither can they liſte vp the ribs, for the Muſcles which liſte them vp are placed without the cheſt and haue their originall from elſewhere, and are called the proper Muſcles of the Cheſt.

The uſe of Muſcles.

Galen. How the intercoſtall Muſcles helpe the Midriffe.

It remaineth therefore that they do preſſe the ribs only, and that but lightly, that the contraction of the cheſt may ſo become equall, being drawn downe together with their contraction and the contraction of the Midriffe: and ſo that is made good which *Galen* ſaith, that they helpe the Midriffe. We may alſo ſay they help the ſixt Muſcle of the cheſt which is vnder the breſt-bone. Yet we will not deny but that they confer alſo to dilatation, but that by accident as *Fallopins* and *Platerus* haue obſerued, to wit, as they ſupply the place of a Ligament, and ioyn the ribs one to another. For when the lower ribs are drawne downeward and dilated by the proper Muſcles of the cheſt; or when the vpper ribs are eleuated by their proper muſcles, it is of neceſſity that the middle ribbes ſhould follow the draught, and ſo the middle diſtances in deep Inſpirations are dilated by the helpe of the intercoſtall whether as they be muſcles or as they bee ligaments; which yet they could not performe if the

They only depreſſe the ribs.

How they conferre to dilatation.

They are rather moued then moue.

Another way how they dilate the distances of the ribs.

proper muscles of the Chest were wanting: and therefore we may more properly say that in this case the intercostall muscles are moued by the proper muscles of the chest, then wee can say they moue of themselves, though their motion is not meereley constraigned but begunne and as it were led the way by other muscles; and haply such a kinde of motion there is also betwixt the *Serratus maior* and the oblique externall muscles of the *Abdomen*. There is another way also how the middle distances of the ribbes may bee dilated by the intercostall muscles; for if on either side the first muscle of the chest (which is called *subclavius*, situated betwixt the first rib and the patell bone or clauicle and hath oblique fibres like the intercostals) do draw vp the first ribbe, then by consequence the other distances vnder shall also in some sort be dilated.

CHAP. V.

Of the Midriffe called Diaphragma.

The Midriffe. The names & reasons of them.



Madnesse in Maids.

It is a Muscfe.

He Midriffe called in Greeke by *Plato διαφράγμα*, of a word which signifieth to distinguish, because it distinguisheth or separateth the instruments of nourishment from the instruments of life and respiration; and in Latine *septum transversum* or the ouerthwart partition, because running ouerthwart the bulke of the body it parteth it into 2. venters [as is manifest in the 1. tab.] This the Ancients as *Hippocrates* in his Booke *de principijs* called *σπέρμα*. i. the minde, not that it hath any intelligible faculty, but because of his notable sympathy with the Brayne: for when this is affected, instantly the minde and all the senses are out of order, and vpon the inflammation of it, followeth a kinde of *phrenitis* or rather a continuall aberration of the mind, and in maydens sometimes madnesse it selfe, as *Hippocrates* sayeth in his Booke *de iis quæ ad virgines spectant*.

It is the 65. muscle seruing for respiration, and differs from all the muscles of the body in excellency, scituation, figure and action. It is one, very great and strong, common to both sides, and as large as the capacity of the lower part of the Chest; as Table 1. declareth.

His scituation in the cavity of the body is ouerthwart and oblique [looketab. 1. a] and declining somewhat downward ouer all that vtmost compasse of the Chest which is limited by the gristles of the bastard ribbes and the lower part of the breast-bone: This muscle whilest it is at quiet remayneth lifted vp as we see in dead carcases, & maketh a great cavity, but when it worketh and is contracted it beareth downeward.

The frame of the Midriffe.

The connexion of it.

Why it is nervous in the midst.

More of the Connexion.

The figure.

The midriffe riseth with two long and fleshy productions [Table 1. and table 2. fig. 2. b i] from the bare rack-bones of the loynes to which it adhereth very strongly, and a great way together, for euery muscle must haue something to rest his head vpon, and most commonly it both ariseth from and is implanted into an immoueable part. The two productions at the sides of the great Artery doe cleaue to the muscles of the loynes [Tab. 1. pp] and becoming broader by degrees doe meete at the eleuenth rack-bone of the Chest, and so make the muscle circular or round, and it is tyed in his fleshy circumference to the inside of the Chest and the ends of the bastard ribbes all along the twelfth ribbe at the lower part of the breast-bone and at the breast-blade [table 1. u] which was made for his defence; but in the middest it endeth into a strong membranous and nervous tendon [tab. 2. fig. 2. b c d] framed of very firme sinewes and membranes. Now it was very necessary that it should be nervous in the middest, partly, for the more security, that it might endure diuers motions without hurt, and not be endangered with payne because of their violence: partly that the hollow veine [tab. 1. and tab. 2. fig. 2. m] and the *æsofagus* or gullet [tab. 1. and tab. 2. fig. 2. l] which passe through it, might not be streightned, and so the course of meate and bloud hindered. Wherefore howsoeuer this muscle worketh, seeing onely his fleshy fibres [tab. 2. fig. 2. f g] are contracted or drawn together, the nervous part about those vessels is neuer constringed: but rather when the fibres are contracted the nervous part from the center to the circumference is distended, and the holes through which those vessels go, wider opened. Moreover, it is vnited to two of the muscles of the *Abdomen*, the oblique ascendent and the transuerse, and aboue, it is so straightly ioyned to the purse of the heart or *pericardium*, that without tearing it cannot be separated from it.

The figure of it is almost [table 2. fig. 2 sheweth it] circular, round like a Plaice or Thorn-backe, or likest a racket which we vse in the Tennis-court, especially if the racket be straight stretched, and the processes are very like to the handle of the racket.

His

His substance is partly [Tab. 2. Fig. 2. fg] fleshy partly neruous [Tab. 2. Fig. 2. a b c d] as if it were compounded of two broad circles, but ending in one part in an acute angle; [table 2. Fig. 2. d] of which the fleshy circle is on every side annexed to the chest [see the first Tab.] and compasseth the other neruous circle which is in the center, to which as vnto a center many fibres like lines do runne from the circumference and as it were from the beginning or originall of the muscle, which that you may rightly discern, you must separate the *Peritonaum* or rimme from the midriffe, which in Hogs may be done easily, but in a man and a dog not without difficulty.

It hath a double membrane one lower from the *Peritonaum*, another vpper arising from the *pleura* with which it is compassed for more strength; although it haue another coat of his owne but a very thinne one, that it might bee distinguished from all other parts by proper circumscription. Veines it hath arising from the trunk of the hollow [tab. 1. m, a b. 6. A] veine called *Phrenice* (sometimes also it receiveth branches from the fatty veine called *Adiposa*) which are accompanied with arteries from the great artery [Tab. 1. e] called also *Phrenica*; [the veines Table 1. n, tab. 6, c the arteries tab. 1. o, table 13. K K] the veines carry vnto it bloud for his nourishment; the arteries vitall spirits together with the vitall faculty, and beside by ventilation with their motion they preserve his naturall heat.

It hath two nerues [Table 2. Fig. 1. P P] proceeding out of the lower rack-bones or *vertebra* of the necke made of three furcles on each side (and this is peculiar to this muscle, for other parts vnder the patell bones or *clauicles* receive none from the marrow of the necke) which nerues being carried through the cavity of the Chest are contorted or wound about the *Mediastinum*, and by it fastned and stayed aloft least they should be hurt. And it was necessary that these nerues should come from an vpper place, that they might more equally extend their action into every part of it: wherefore they are disseminated through his whole substance, that they might affoorde vnto it all sence and motion, whence it is of very exquisite sence, and when it is iniured for the most part death followeth.

It hath two passages or holes, one on the right hand [Table 1 and Table 2. fig. 2. m] in the middle neruous part for the ascent of the hollow veine out of the vpper and gibbous part of the Liuer vnto the Heart; another on the left hand [tab. 1. and tab. 2. fig. 2. l] a little backward and greater, through which passeth the *Oesophagus* or gullet and two nerues vnto the stomacke, vnto which notwithstanding his membranes do grow and encompasse streightly and very strongly.

At the originall or beginning of this muscle or midriffe betweene his productions [tab. 1. and tab. 2. fig. h i] at the racke bones, there is a diuision [tab. 1. and table 2. fig. 2. k] resembling a semicircle or halfe Moone for the descent of the great Artery and the veine without a peere or *non parill*; and for nerues of the sixt payre fixed to the ribbes which are carried vnder the *pleura*; and this diuision imbraceth the racke-bones vpon which the great artery leaneth.

The chiefe vse of the Midriffe, which *Galen* found out, as appeareth in the 15. and 7. Chapter of his 5. Booke *de vsu partium*, and which dependeth especially vpon his scituation, is that it might be the organ or instrument of free, gentle, and voluntary respiration or breathing, euen as the instruments of violent or deepe breathings are the 64. muscles which are about the Chest exactly dilating or contracting it. For his fibres being equally retracted or drawne together, all the bastard ribs are drawne toward the centre of the chest, and so they draw the vtmost parts of the Chest vnto the rack-bones, and constringe or contract the lower part, whereupon the Midriffe is lift vp, streatched and serueth for expiration. Hence it is that in a dead body it alwayes appeareth contracted and streatched, for the life endeth with expiration, and if the Chest be perforated within the ribs or Midriffe it falleth straight loose downward, and suffereth the Liuer and the stomack which before were somewhat suspended, to fall. But when the fibres are loosened the Midriffe falleth; for the bastard ribs are loosened, and the lower parts of the Chest, and consequently the Lungs are dilated and so we draw in breath: wherefore when the Midriffe is hindred or affected, then must needs follow difficulty of respiration, as *Galen* saith in the 8. Chapter of his 4. Booke *de locis affectis*. This motion according to some authors, (*Archangelus* among the rest) is mixed of a voluntary and a naturall motion, voluntary it is but not simply, because there is a necessity which vrgeth and exacteth this motion: as in respiration a necessity of cooling the heart vrgeth, euen as in vnburdening the belly & making water the excrements do vrge & prouoke the *sphincter* muscles of the Fundament and of the Bladder.

The substance

The fibres of it

The membranes of it.

His veines.

Arteries.

Sinews.

A propriety.

Why his nerues come from above.

The passages.

His diuision for the artery and the veine non parill.

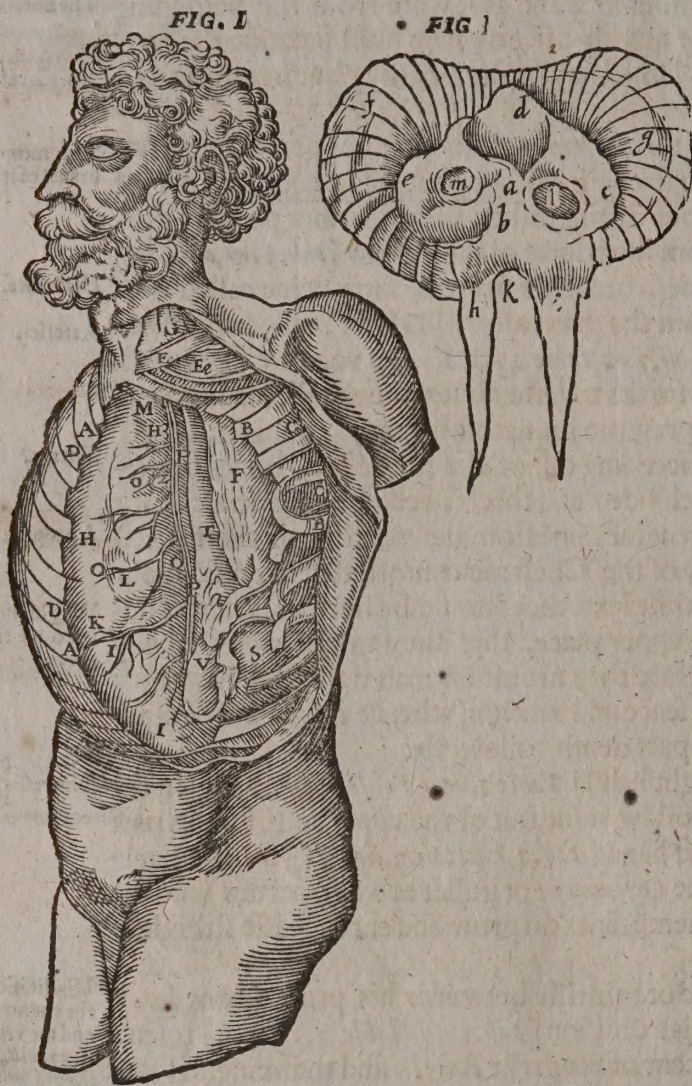
The vses of the Midriffe. The chiefe vse.

Of what kind the motion of the midriffe is.

Ano-

The 1. Figure sheweth the middle Belly, the Skinne and the Muscles being cut away, the Brest-bone also is removed and the ribbes broken, that the capacity of the Chest, the Membranes thereof and the Lungs might better be discerned.

TABVLA. II.



- A, The gristles of the ribs retracted or drawn back.
 BB, the bony part of the rib diuided from the gristle.
 CC DD, The *Intercostal* muscles filling vp the distances of the bones at CC, and the distances of the gristles at DD.
 E, the clauicle or collar bone discovered in his seate.
 Ee, The course of the vessels running to the arme-hole.
 G, The outward *Inguinal* veine which shewes it selfe as soone as the skin is cut.
 HH, The *Mediastinum*.
 II, The surface of the midriffe.
 K, The connexion of the *Mediastinum* with the midriffe.
 L, A place somewhat bunching to receiue the heart.
 MN, The *Mammariæ* veine and artery descending vnder the brest-bone.
 OO, Branches of the vessels before named which go to the *Mediastinum*.
 PP, The nerues of the midriffe supported by the *Mediastinum*.
 Q, A veine which together with the nerue descendeth to the midriffe.
 RSTV, A part of the lungs in the left side of the cavity R, and T, shew the vpper lobe, S, and V the lower.

Figure II sheweth the midriffe taken out of the body.

- a, The midriffe.
 bc de, The sinewy part thereof.
 fg, The fleshy part thereof.
 hi, Two fleshy originals.
 k, A diuision or perforation of the midriffe where through the great artery is transmitted.
 l, The perforation on the left side, which giueth way to the gullet.
 m, The right perforation through which the hollow veine ascendeth.

Another vse.

Another vse of the midriffe is to ventilate or fanne the *Hypochondria*, especially the Liuer, because in his conuex or vpper part it wanteth Arteries to doe that office; as also the moyst vapours containd in the capacity of the lower belly, least being at rest they should putrifie and corrupt; for which cause *Hippocrates* in his first Booke *de morbis mulierum* calleth it the breather or bellows of the lower belly.

A third vse.

Another vse of it is, as *Galen* aduiseeth vs in the 9. Chapter of his second Booke *de motu musculorum*, to helpe forward the expulsion of the excrements and the Infant in trauell by helping the muscles of the *Abdomen* as wee haue shewed in the former Booke; for which it is the more conuenient because of his oblique scituation. For aboue it presseth the gurttes as it were with hands, and so driueth the excrements downward, which otherwise might as well be excluded vpperward as downward if this helpe were not.

The last vse of the midriffe.
Plato.
Aristotle.
Plinius conceit

The last vse is, that according to *Plato*, it might deuide the *Irascible* or Angry part and faculty of the Soule from the Concupiscible and lustfull; or according to *Aristotle*, it might distinguish the naturall parts from the vitall, the ignoble from the noble, that the vapours which arise from the lower parts as from the sinke of the body, might not offend the heart the seate of life and sence as he thought. *Plinie* ascribed to it the subtilty or nicenesse of the wit, and esteemed it the seate of mirth which appeareth by tickling: for if the skinne about the *Hypochondria* be gently touched we are tickled and laugh presently; but more rare was that of a young man in my knowledge, who had the cause of an Epilepsie in his foot, which at certaine times would rise vp and might be stayed by binding the legge and thigh, but when the vapor or breath came vp about the place of the Midriffe, then would he laugh extreamly and presently after fall in his Epilepticall fit. But the Philosophers reason

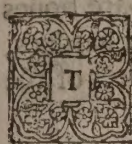
son was, because the motion commeth presently to that place; for that the skin is thin and warmeth the part, though lightly yet enough to open it, and so moueth the minde euen against the will of him that is mooued. For in the single Combats of Sword-Fencers (called *Gladiatores*) at sharpe vsuall in those times, some haue bin seene to dye laughing when they haue bin thrust through about that part.

And the reason why onely men of all creatures are ticklish, is partly the thinnesse of the skin, partly because a man onely of all creatures can laugh; for titillation is the cause of Laughter, when such a part is mooued as from which the affection may rise vp and fill the wings of the nose.

Another.
How tickling
causeth laugh-
ter.

CHAP. VI.

Of the Membrane called Pleura.



He *Pleura* is a Membrane taking his name from the Ribs which they call *πλευράς*, because it is stretched vnder them al, excepting the twelfe, and truely it is called a Membrane because of his substance, and a coate because of his Vse.

The Pleura.

It is a Membrane enclosing the whole cavity of the Chest, wherefore his Figure and magnitude is answerable to that cavity, which is Semiouall or like halfe an egge. It ariseth and is bred of spermatieall filaments or threds of the seed and the mothers blood powred betweene them after the manner of a *Parenchyma* or as the flesh of the Liuer or other of the bowels; or it is produced from the Membranes of the Braine which inuest the Marrow of the backe, which being brought together with some Nerues into the Chest do on both sides frame it; wherefore there it is thicker and cleaueth strongly to the rack bones or *Vertebra* of the backe, from which vnlesse it be broken it cannot be separated, because from thence it hath his beginning of the place or production.

His figure and
magnitude.

His originall

It is tyed backward to the racke bones of the backe, which is the reason that some haue said it ariseth from their Ligaments, or from the Ligaments of the *Vertebra* of the Chest as *Fallopini*; before, it is tyed to the brest-bone; on the sides to the Membranes of the intercostall Muscles, and to the Membranes which immediately compasse the rib bones; aboue to the Clauicles or Patel-bones; below in his *Basis* as *Galen* calleth it, 5. *Administ. Anat.* 8. or bottome, to the Midriffe, and in the middest vnto the Lungs and heart-purse or *Pericardium*.

His connexion

His substance is like that of the *Peritonaeum* or rim of the belly, but in strength and thic- nesse somewhat exceeding it; for because it was to passe betweene the bonie hardnesse of the ribs and the soft bodies of the Lungs, it was ordained neither too soft nor too hard, yet somewhat hard the better to defend the Vital parts; thight and close wrought yet light, that the weight of it might not hinder the motion of the Chest, but strong and neruous, hard to be diuided, and sometimes in some diseases of the Chest it hath beene obserued by *Platerus* to grow ten fold thicker then vsuallly it is.

His substance
and structure.

It is all ouer double, partly because of the hardnesse of the bones, that the inner side which is very sensible might not be hurt by the continuall motion of the Lungs, partly that betwixt both the Membranes the intercostall vessels might more safely passe.

It is double &
why.

The one of these is thicker, especially about the backe where it may be cleane seuered from the ribs; and it is harder because of the continuall motion of the Lungs and his inner face is smooth and smeared ouer with moysture, the vtter superficies or face of it is vnequal and rugged. The other is thinner, and of some is called the Membrane compassing the ribs. Betweene these two is the matter of the Pleurisy oftentimes collected (because there are vessels which run betweene them) and not onely betweene the Pleura and the intercostall Muscles. From this Membrane sometimes on one side sometime on another, (as *Vesalius* and *Valnerda* haue well obserued) but especially on the left side, doe certaine sinnowy Fibres come; by whose interposition the Lungs are strongly tyed to this *Pleura* in men when they be in health, and among them is seene some small portions of fat neere the rack-bones of the back where the vessels are greater, as it is in the *Peritonaeum*; but this is but rare. And as the intercostall Muscles like other Muscles haue their proper Membrane, so the ribbes like other bones are compassed with their *Periostion* or proper and immediate Membrane, which *Vesalius* that oculte Anatomist tooke to be one of these Membranes which we haue described.

Where the
matter of the
pleurisy lyeth.

It

His perforati-
ons.
Aboue.
Below.

At the sides.
His vessels.

His vse.

It is perforated where it sendeth vessels into the Chest or out of it. It sendeth out aboue the iugular and Axillary Veins, and the *Carotides* or Axillarie Arteries; but it letteth in the Gullet, the Weazon, and a Nerue of the fixt paire belonging to the Midriffe; below, it is perforated at the *Diaphragma* or Midriffe; for the ascent of the Hollow veine, & the descent of the Gullet as was saide in the former chapter; at the sides for the intercostall vessels. The vessels which are tied vnto it as they passe vnto the Neighbour parts doe lend it small branches which come most plentifully from the Mammary and intercostall vessels. Hence it is that it is often inflamed with great tension and a pricking or goading paine.

His vse. His vse is much like the vse of the *Peritonaeum* or Rimme in the Lower belly; for as the *Peritonaeum* is stretched about all the parts of the Lower belly, and affordeth vnto euerie one of them a common coate; so the *Pleura* is stretched vnder all the cauitie of the Chest, and giueth a common coate saith *Galen* to al the instruments of breathing, as also to the midriffe and the intercostall muscles and the vessels, and defendeth and knitteth them altogether. It giueth also to the vessels a safe wastage and a kinde of stability, and where it is stretched vnder the ribs, it serueth the Lungs for a defence, that they light not vpon the bare bones when they dilate themselves in the gathering in of breath, & so be hurt with their hardnes, and beside that the lungs in their motion do not intangle themselves in the distances of the ribs.

CHAP. VII.

Of the Mediastinum.

The Mediasti-
num.
His Names.



He *Mediastinum* so called, because it mediateth or diuideth the Chest in the midst. *Columbus* calleth it *Intersepimentum* and *dissepimentum*, as a hedge that diuideth two Pastures. It is double: The right [tab. 3. G G the right, H H the left] and the lefte, which *Galen* calleth *Septum Diaphragmatis*, because they diuide the cauity of the Chest, which the *Pleura* encompasseth into two parts. For the cauity of the Chest is not one open and continuall, but is diuided by these membranes. Wherefore in the middle of the chest there is one on either side which passeth from aboue downward according to his Longitude euen vnto the Midriffe, and backward from the Breast-bone vnto the Racke-bones, so that the chest is by this meanes diuided into two circles, or if you had rather, they frame a certaine Triangle of vnequall and oblique sides, for they haue space enough to resemble this Figure, because of the deapth and length of the Breast.

His situation.

His originall.

His substance.

These Membranes do arise from the *pleura*, which where it climbeth from his originall on either side to the sides of the breast-bone, creepeth so backe againe towards the ridge where his beginning was, that it attaineth from the midst of the breast to the very spine of the backe. These are thinner then the *pleura*, and softer that they may more easilie follow the motion of the heart, on the outside as they looke to the Lungs to which they sometimes grow, they are smooth, and oftentimes about the vessels they appeare interlaced with much fat, so as they may bee compared to the Kal or *Omentum*; on the inside rough, because of the Fibres with which the Membranes are ioyned, as also to the *Pericardium*; and in the hollow of the throate the *Thymus* so called (of which we shall heare afterwards) groweth vnto them. Heere, according to the length of the racke-bones of the backe vnto which they are ioyned by the mediation of the *pleura*, they euen touch together, and make but a very narrow cauity, but are after by degrees seuered and at the Breast-bone stand as wide asunder as the Breast-bone is broad, to which they cleaue euen from one end of it to the other; and this distance [Tab. 3. L L] is intertexed or wouen betweene with diuers threddy Fibres and Membranes; but they are widest asunder & make the largest distance at the *Diaphragma* or Midriffe, to which they are ioyned as [Tab. 2. fig. 1. K] as his neruous part reacheth, in somuch that this cauity which is smooth and moist, before containeth the heart knit vp in his purse and the hollow-veine ascending vpward, and behinde the gullet with the stomack Nerues.

Their distace.

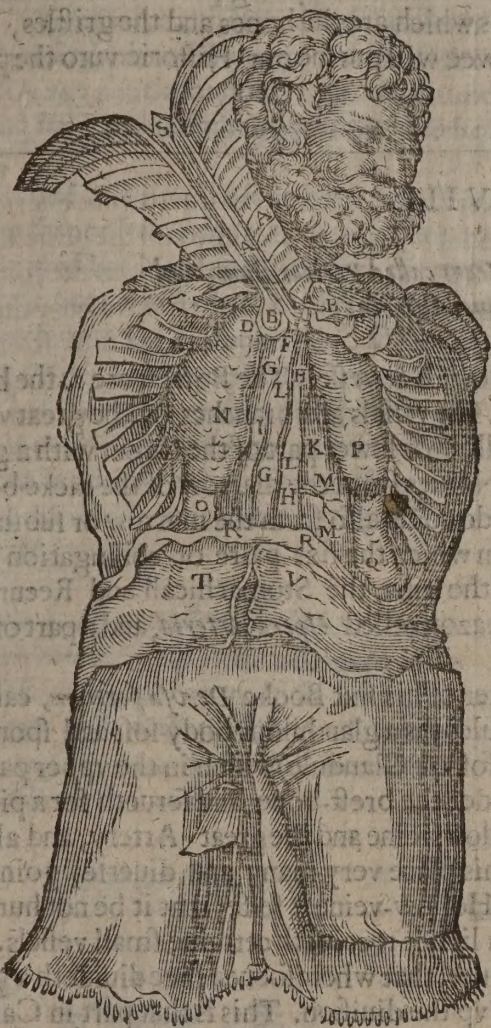
Where the distance is widest.

A disease resembling a Pleuresie.

In the fore-part of this Cavity there is oftentimes a matter conteyned, which causeth a disease resembling a Pleuresie, which matter if the breast-bone (saith *Columbus*) bee verie cunninglie perforated may bee safely drawne out. In Dogges this Cavity is more large but hath no such webbe of Fibres as in a man. The Veynes and Arteries that it hath are very

Table 3. sheweth the middle belly before and at the sides, bared from the skinne to the Muscles, wherein also the brest-bone with the gristles of the ribs are separated from the Mediastinum and reflected backwarde, that those things which are conteyned in the Chest may better bee perceived.

TABVLA. III.



AAA. The middle *A.* is the inside of the brest-bone; the other two shew the inside of the gristles and the ribs ioyned together.

BC. The *Mammary* veines descending vnder the brest-bone vnto the right Muscles.

DE. The *Mammary* arteries descending.

F. Certaine glandules or kernels about the collar bone, appointed to secure the distribution of the vessels.

GG, HH. The right and the left side of the *Mediastinum*, which before the diuision of it did grow vnto the brest-bone.

IK. The right and left superficies of the same *Mediastinum*, which is next to the lungs.

LL. The distance betwixt the membranes of the *Mediastinum*.

MM. This swelling place sheweth the scite of the left part of the heart.

N. The vpper part of the right Lobe of the Lungs.

O. The lower part of the right Lobe of the Lungs.

P. The vpper part of the left Lobe of the Lungs.

Q. The lower part of the left Lobe of the Lungs.

RR. The Midriffe separated from the brest-bone, and from the tops of the

gristles which cleaue vnto it. *S.* The Gristle called the brest blade. *TV.* The skindrawne downward from the foreside of the Chest.

very smal from the *Mammary* [tab. 3. *BCDE*] which passe from the hole of the throat downward vnder the brest-bone, from which in their passage as also from the vein *Non-parit* they borrow a sacle. [tab. 2. fig. 1. *OO*, from the *Mammary* vessels.] Moreover in a man it receiue a good large veine out of the hollow of the throate, which descendeth accompanied with a Nerue [tab. 2. fig. 1. *Q*] by the whole length of both the Membranes to the Midriffe, but groweth onely to their outside, sometimes also it receiue small branches from those Vessels which we haue before named *Phrenice*, that is, the vessels of the Midriffe.

The vse of this *Mediastinum* or bound hedge is first to hold the heart vp suspended; for being tyed to the purse of the heart it must needs do that office, lest if it had no such ty, but hung down at liberty, in the diuerse positiō of the body it might fall to the sides, to the brest, to the spine, or else downward. Secondly, this serues to strengthen and secure the passage of the vessels. Moreover, it incompasseth the parts conteyned in the Chest, that they should not hurt the Lungs in his motion. And finally, it diuideth the Chest into two parts or caviities which is their chiefe profit saith *Galen* in the 3. chapter of his 6. Booke *de respiratione*. so that if one part be hurt, yet the other may be safe: as was haue knowen a theefe Anatomized who was a strong and stout fellow, but had one side, that is, the right side of his lungs withered almost all away and dried vp into a very small quantity, but the other remained faire and fresh as any other mans. So in wounds, if one part bee very sorely wounded, so that because of the entrance of the outward aer the motion of the Lungs do cease; yet the other part will not be wanting to susteine life by performing his part of the worke. For, if both parts of the Lungs be wounded any thing wide through, the voice and respiration too must

The vses of this *Mediastinum*.

Their cheefe vse.

A strong and stout mā with one Lung.

8. William
Eug.

must needs perish : although I saw when I was a Boy a Knight wounded, quite thorough the backe on both sides the bone, and so deepe that on both sides in his dressing his breath would at the mouth of the wound blow out a Candle, and yet the Patient hath perfectly recovered. And this shall suffice to have spoken of the Conteyning parts of the Chest, especially of those that are soft, for the hard parts which are the bones and the gristles, will fall out better to be handled afterward. Now wee will pursue our Historie vnto the parts conteyned.

CHAP. VIII.

Of the Thymus and Purse of the Heart called Pericardium, and the water conteyned therein.

The parts con-
teined in the
Chest.
Bowels and
Vessels.
Veines.
Arteries.
Thymus.
Nerues.

The first con-
iugation.

The Thymus.

Why it is fra-
med.

Note.

The Pericar-
dium or purse
of the heart.

His Figure.

Connexion.

His originall.

His substance
and the rea-
sons of it.



He contained parts of the Chest are, Bowels & vessels. The Bowels are 2. the heart covered with his purse and the Lungs. The vessels are branches of the great veine & the great artery, borne vp in the hollow or lower part of the throat with a glandulous body called *Thymus*, double Nerues from the marrow of the racke bones of the Chest, from which the intercostal nerues do come also from the marrow or substance of the braine contained within the scull, from which the sixt paire or coniugation proceedeth, and from it the *Costalis* or the sinew of the ribs, the Stomachicall and Recurrent both the right and the left; and finally, the Weazon called *Aspera Arteria*, and a part of the *oesophagus* or Gullet. But first of the *Thymus*.

The *Thymus* which *Galen* in the fourth Chapter of his sixt Booke *De usu partium*, calleth *Thymus*, his Interpreter, the lowest of the Glandules; is a glandulous body soft and spongie. (*Galen Administ. Anat.* 7, 9. calls it the great and softest Glandule) which in the vpper part of the Chest neere the hole of the throate lyeth vnder the brest-bone, and serueth for a pillow or boulder to secure all the diuisions of the Hollow veine and the great Artery, and all the sproughts that come from them, which are in this place very many and diuerse, going to the armes and the shoulder-blades; as also the Hollow-veine it selfe, that it be not hurt by the hardnesse of the brest-bone, from whom in lieu it receiueh certaine small vessels. For this is an ordinary and perpetuall worke of Nature, that wherefoeuer she diuideth a great vessell, there she interponeth a Glandule to fill vp the diuision. This is that part in Calues, which is accounted among the delicates of the Table, and is called *Lactes* or the sweete bread.

The Purse of the Heart, called of the Grecians *Pericardium*, of the Latines *Cordis involu- crum* and *Capsula*, *Camera*, or *Aula Cordis*, *Hippocrates* in his Booke *de Corde*, calleth *Culeus*. It is a large Membrane, couering and encompassing all the heart; and carrieth his Pyramidal Figure [Tab. 4. figure 1. D E F] or rather is like a pine Apple, hauing a broad *Basis* aboue, and ending by degrees in an obtuse angle. [Tab. 4. figure 1. F] This is placed in the midst of the double *Mediastinum*, and is embraced by it on either side, to which it groweth round about by the mediation of many Fibres. It is also tied before to the *Pleura*, where the Gristles of the sixt and seauenth ribs on the leste side are ioyned to the Membranes of the *Mediastinum*, where they part or gape from the brest-bone; behinde to the spine of the backe; below to the sinewy circle [Table. 4. figure 1, from E to G] or Tendon of the Midriffe his point [Tab. 4. fig. 1, F] doth so strongly adhere especially on the left, as also on the right [Tab. 4. Fig. 1, Q] side that it cannot be separated without tearing it asunder, and this Connexion is peculiar onely to man. For in other creatures as Dogges and Apes, it standeth off from the Midriffe and is not tyed to it.

The Originall [Table. 4. fig. 1, B. fig. 2. A] of this Membrane at this *Basis* is large, produced from the coats which the *Pleura* affoordeth vnto the foure vesselles which yssue out of the heart; for these vesselles in all that distance which is betweene the *Basis* or broad end of the heart and this *Pericardium*, haue not the common coate from the *Pleura*, because it is employed in the frame of the *Pericardium*.

His substance both for thicknes and strength (as *Galen* sayth in the first chap. of his 6. booke *de usu partium*) is very proportionate; if it had been harder then it is, it would haue offended the Lungs by pressing them; if softer, it selfe might haue bine pained by the bones: for as his position is betweene two contraries, so is his substance middle betweene two extremes.

For

For it is so much softer then a bone, as it is harder then the Lungs; but indeed the *Pericardium* toucheth not the Lungs but by the interposition of the *Mediastinum*, least they should hinder one another in their motion, alwaies I except the fore part of the brest-bone, where the membranes of the *Mediastinum* stand off one from another.

This purse is hard, because of the continuall motion of the heart; on the outside fibrous, within smooth and slippery, that the heart might mooue more freely in it, but on neither side hath it any fat, although *Aristotle* saith otherwise, whom *Vesalius* imagined to be deceived by taking for it the Membranes of the *Mediastinum*, which are indeed sometimes fat as we haue said.

It is tied at the *Basis* of the heart, which is at the 5. rackbone of the Chest, to the vessels which come thence [tab. 4. fig. 1. B, fig. 2. A] which also it bolstereth; but to the body of the heart it is not tyed but is as farre from it at the *Basis*, the point and the sides [tab. 4. fig. 2. BB sheweth the *Pericardium* bent backe to the sides] as is sufficient for the dilatation of the heart, and for the ferous humor heerein contained. Wherefore it is on euery side a little distant from it; which distance if it had beene larger it would haue taken vp too much of the cavity of the chest, and so haue bin a hinderance to Respiration.

It is continuall or whole round about except in the *basis*, where it hath at the last five perforations for the entrance of the hollow veine [tab. 4. fig. 1. A, fig. 2. F] and for his egressse, as also to let out the Arteriall veine, [tab. 4. fig. 2. G] the venall Artery, and the great Artery. [Table 4. fig. 2. H.]

His Connexions.

His perforations.

Table 4. Figure 1. sheweth the heart included within his purse or *Pericardium*, together with the Lungs and a part of the *Midriff*.

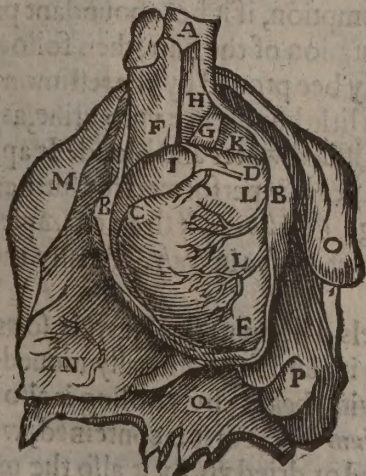
Figure 2. sheweth the *Pericardium* opened, and so the situation of the hart and particularly the fore part thereof.

TABVLA IIII.

FIG. I.



FIG. II.



A, A portion of the ascending trunk of the hollow Veine.

a, A portion of the Great Artery.

B, The beginning of the *Pericardium*, cleaving very close to the hollow veine, vnto the Arteriall vein and to the Great Artery.

C, The small Veines of the *Pericardium* or Purse of the heart.

DE, The foreside of the *Pericardium* bearing the figure of the basis of the heart.

F, The sharpe end of the *Pericardium*. From F, to G, the connexion of the *Pericardium* with the midriff.

H, A part of the *Septum transversum* or the midriff.

I, His Nerves.

L M N O, The foure Lobes of the Lungs.

The second Figure.

A, The place where the *Pericardium* is continued with the vessels of the heart.

BB, The *Pericardium* reflected to the sides.

CD, The Basis of the fore-part of the heart.

E, The point of the fore-part of the heart called *Mucro*.

F, The Hollow Veine.

G, The Arteriall Veine.

H, The great artery & the venall artery, which cannot be scene vnlesse the heart be leaned to the left side.

I, The right eare of the heart.

K, The top of the left eare.

L, The coronary or crown-veine and artery of the heart.

LL, Certaine branches proceeding from these vessels.

M N O P, The foure Lobes of the Lungs.

Q, A part of the Midriff.

His vessels.

It receiveth very smal veins [*tab. 4. fig. 1. C.*] and threddy, partly from those that are sent to the *mediastinum*, partly from the veins called *Phrenica* where they are ioined to the midriffe; some say it hath a smal branch from the *Axillary* veine which they cal the *Capsulary* or purse-branch, though *Laurentius* will haue it to come from the *subclavian* Veine. It hath no Arteries vnlesse they be exceeding small, because being so neere vnto the heart it may receiue vitall spirits at hand from it. His nerues are very smal & sometimes scarcely sensible, but from the left branch of the Recurrent sinew to giue him sence.

His vses.

His vse is to be as a habitation and shelter for the heart or as a mantle to couer it, and being of all membranes (except the *dura mater* of the Braine) the strongest, it keepeth it also from pressure that his motion be not impeached, and that it touch not the hard bone. Moreouer it containeth a serous humor whereof we will speake in the next place, and serueth in stead of a ligament together with the helpe of the membranes of the *mediastinum* to reteine the heart in his right seate. *Galen* in the 13. Chapter of his 7. Booke *de Anatomicis Admin.* telleth a strange story of a childe whose breast-bone was cut out, and this *Pericardium* rotted part of it off, and yet the child recovered.

A Historie.
Marilus his
boy.The humor
contained in
this purse.What is the
matter of it.That it speth
out of the ves-
sels.That it is part
of our drinke.That it is
found in liuing
bodies.
But more in
dead and why.In found bo-
dies as well as
in diseased.
The example
of our Sauror.

The vses of it.

In this purse there is contained a watery humor as *Galen* calleth it, carrying the forme of v-rine: wherefore the diuine senior *Hippocrates* who in his Book *de Corde* calleth it *urina*, saith that the heart dwels in a Bladder, yet this water hath no acrimony or saltnesse in it. It springeth partly from a humour which typeth out of the vessels (I meane the veines and arteries of the heart) which the heart as *Hippocrates* speaketh drinketh in, licking vp withall the drinke of the Lungs and pisseth it out againe (for the watery humor is by the high feruour of the heart driuen forth, as we see in greene wood when it is burnt) partly of a portion of the drinke which soaketh in the passage through the sides of the weazon, as it were a deaw and falleth downe hither, and from hence some of it into the venall arteries. The first is proued by the cure of the palpitation of the heart which is caused of the aboundance or ouerplus of this humour, which is turned sayth *Galen* in the second Chapter of his fift Booke *De locis affectis* by blood letting; when together with the blood the serous humor is let out which before fell into the *Pericardium*.

The latter is euicted by an example propounded by *Hippocrates*, for sayth he, if you giue a Pigge that is very dry water mingled with *Minium* or vermillion and presently stick it, you shall finde all his winde-pipes along dyed with this coloured drink; some would haue it to be generated from moyst vapours and exhalations rayled from the humors of the heart, and driuen forth by his perpetual motion and high heate vnto the *Pericardium*, by whose density they are turned into water: and of that opinion are *Falopius*, *Laurentius* and *Archangelus*; who remembreth fixe opinions concerning the matter of it, which we shall hereafter make mention of.

This humor is found not onely in dead bodies as some would, but also in liuing, but more plentifull after death (except in those that dye of consumptions in whome it is little and yellowish) because the many spirits which are about the heart, the body being cold are turned into water euen as those vapors which are raised from the earth are by the coldnes of the middle region of the ayre conuerted into water: we also affirme that it must of necessity be in liuing bodies, and not only in those that are diseased, as they that are troubled with palpitation of the heart, but also in all sound bodies; yet in some more plentifull in others more sparing, but in all moderate; because if it be consumed there followeth a consumption, if it be abundant palpitation of the heart, and if it be so much that it hinder the dilatation of the hart, then followeth suffocation and death it selfe. That it is in liuing bodies may bee proued by the testimony of *Hippocrates* in his Book of the heart, where he saith there is a litle humor like vnto vrine, as also by the example of our Sauror out of whose precious side issued water and blood. It appeareth also by the dissection of liuing creatures which euery yeere is performed for further aduertisement, especially a sheep or such like great with young; *Vesalius* addeth an example of a man whose heart was taken out of his body whilest he liued at *Padua* in *Italy*. Finally the vse and necessity of it doth euict the same.

For the vse of it is to keepe moyst the Heart and his vessels; a hot part the Heart is, so as the left ventricle will euen scald a mans finger if it be put into it, and so continually moued that vnlesse it were thus tempered it would gather a very torrifying heate; by cooling it also keepeth it fresh and flourishing. It moystneth also the *Pericardium* wherein it is contained, which otherwise by the great heate of the heart would be exicated or dried vp. By it also the motion of the heart becommeth more facile and easy, and this motion spendeth it and resolueth it insensibly

sensibly by the pores as it is bred; but if in the passage it be stayed, then saith *Varolius* are there many hairs found growing right against it on the brest. Finally, it taketh away the sense or feeling of the waight of the heart, because the heart swimmeth as it were in it, euen as we see the Infant swimme in sweate in the wombe, as well to take away the sense of the waight of so great a burthen from the Mother, as also that it might not fall hard to any part in her body; you may adde to this if you please, that it helpeth foward the concretion of the fat about the heart.

The cause of hairs vpon the brest.

In the cavity also of the Chest there is found such a like water mingled with blood with which the parts of the chest are continually moistned and cooled. And thus much of these circumstances of the heart. Now follow the Vessels of the chest.

Another water and blood mingled in the Chest.

CHAP. IX.

Of the ascending trunk of the Hollow veine.

The trunk of the Hollow veine hauing perforated the *Diaphragma* or Midriffe, [tab. 5. fig. 1. from A to D, tab. 6. from B to H] runneth along the Chest as high as the *Patel-* bones before it be diuided. It is greater then the descending trunk, because it is to

Table 5. Figure 1. sheweth the diuision of the Hollow veine in the *Iugulum* or hollow under the *Patel-* bones. On the right side is sheweth how it is commonly beleued to be diuided into two trunks, the one called the *Sub-Clauius*, the other *Super-Clauius*, from whence came that scrupulous choise of the *Cephalica* and *Basilica* Veines in *Phlebotomy* or blood letting. On the right side is shewed how the tranke is but one, out of which both the foresaid veines of the arme do proceede.

Fig. 2. sheweth a portion of the Hollow veine as much as ascendeth out of the right ventricle of the heart vnto the *Iugulum*, wherein is exhibited the nature of the Fibres which are in the bodies of the veines.

TABVLA V.

FIG. I.



FIG. II.



FIG. III.

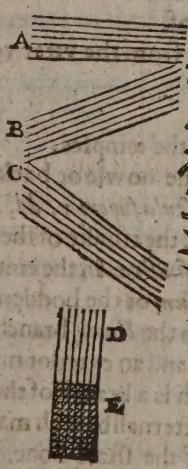
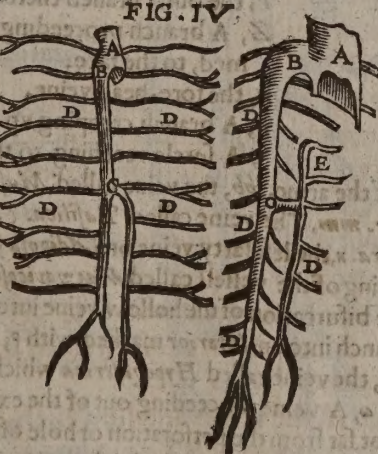


FIG. IV.



- AA, The trunk of the hollow veine from the heart to the *Iugulum* or Sticking-place.
- B, The Coronary veine of the heart.
- C, The veine *Azygos* or fine part.
- dd, The branches of the fore saide veine called *Intercoastales inferiores*.
- D, The diuision of the hollow vein in the *Iugula*.
- EE, The *Mammary* veines.
- F, The vpper *Intercoastall* veine.
- G, The veine called *Subclauia*.
- HH, The *Cephalica* or head veine yssuing therefrom.
- II, The veine called *Hepatica* or the *Liuier* veine issuing also from the *Subclavian* tranke marked with G.
- KK, The internall *jugular* veine.
- LL, The externall *jugular* veine.
- M, The *Subclavian* veine, out of which issucth the right *Liuier* veine at Q.
- N, The *Superclavian* veine out of which issucth the right head veine at P.
- OO, The veines called *Cernicales* or neck veines.
- Q, the *Hepatica* or *Liuier* veine.
- P, The *Cephalica* or Head veine.

The second Figure.

- AA, The trunk of the Hollow-veine.
- B, The veine *Azygos* or the vnated veine.
- C, The diuision of the hollow vein in the *Iugulum* on either side into two branches as it is commonly receiued.
- DD, The *subclavian* branches.
- EE, The *superclavian* branches.
- FF, The externall *jugular* veines.
- GG, The internall *jugular* veines.

Figure 3. sheweth a rude delineation of the Fibres in the bodies of the veines.

A, The transuerse or ouerthwart Fibres. BC, The oblique or slope fibres of each kind. D, The right fibres. E, The implication or texture of the 3. kinds of Fibres.

Figure 4. sheweth the distribution of the veine *Azygos*, which we shall shew more distinctly in the 7. Table.

A, A part of the trunk of the hollow veine. B, The originall of the veine *Azygos*. C, O, The diuision of the same vnated vein at the eight rib. D D D D, The right and left *intercoastall* veines.

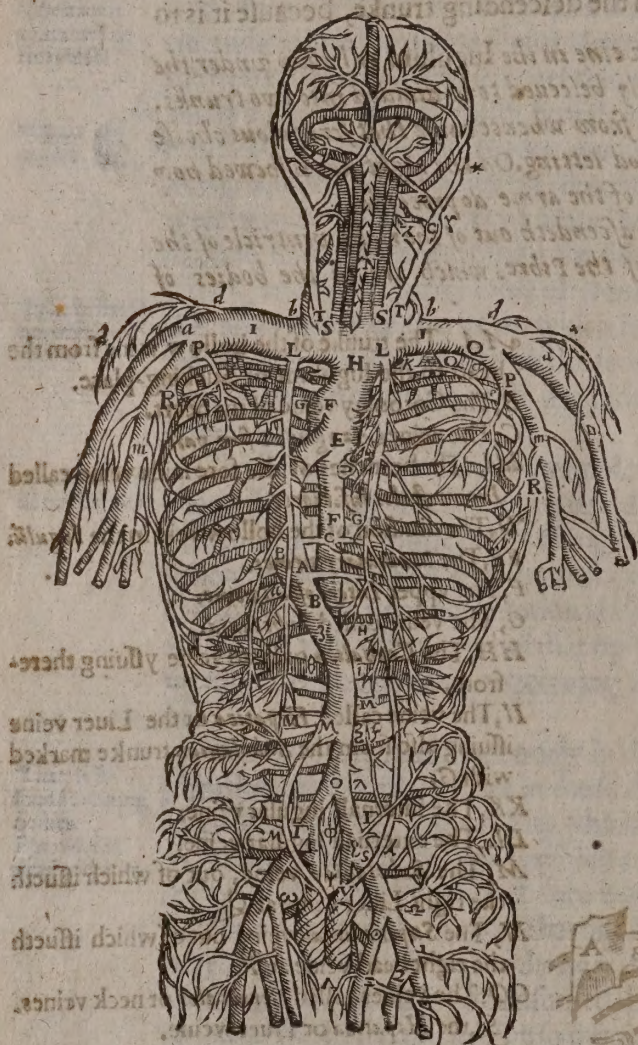
conuay bloud to more parts, it hath also vnder it the *thymus* or sweet-bread, that thereby being bouldered it might more safely be diuided.

Before the diuision it sendeth out foure branches.

The first is called *Phrenica* [tab. 6. C] or the veine of the Midriffe, one on each side, which diuersly are disseminated through the Midriffe, and beside it transmitteth branches to the *Pericardium* and the *Mediastinum*: the right issueth out of the trunk sometimes in the chest, the left alwaies vnder the Midriffe: then the trunk of the hollow veine perforateth the *Pericardium* and inclining a little to the left hand [tab. 6. above B] degenerateth into the right eare of the heart [tab. 6. D] and is fastned into the right ventricle of the heart into which as into a Cisterne it powreth his blood. The second is called *Coronaria cordis* [tab. 5, fig. 2, B, tab. 6, E] the

Table 6. sheweth the trunk and branches of the hollow vein as they are disseminated through all the three Regions of the body.

TABVLA VI.



aa, the veine called *Cephalica* or the vter veine of the arme. bb, the veine called *Muscula superior*. dd, A veine climbing to the top of the shoulder which is sometimes double. mm, The veine called *Basilica*. z, the trunk of the hollow veine vnder the Liuer. x, the right fatty veine or *Adiposa dextra*. n, the left fatty veine or *Adiposa sinistra*. o, the emulgent veines. lll, the right and left spermatike veines. r, the beginning of the vessell called *Vas vasicosum* or the bodden vessell. s, the veines called *Lumbares* or belonging to the loynes. a, the bifurcation of the hollow veine into the *Iliack* branches. p, the vpper veine called *Muscula*. ps, A diuision of the left *Iliack* branch into an *Interior* marked with p, and an exterior marked with r. r, the veine called *Muscula media*. q, the veine called *Sacra*. v, the veine called *Hypogastrica* which is a branch of the inner bow marked with v, descending to the bladder and the wombe. w, A veine proceeding out of the externall branch marked with v, which is ioyned to the small branches of the inner veine not far from the perforation or hole of the share-bone. t, the veine called *Epigastrica* which is an exterior shoot of the branch s, rising vpperward. Δ, the veine called *pubenda*, an interior shoot of the branch s, going to the genitals. θ, the first skin-veine of the leg descending to the toes of the feete. λ, A branch offered to the place of the groyn or lesk. Σ, A branch creeping through the skin of the thigh. Ω, the veine called *Muscula inferior*, creeping through the place where the hip is articulated or ioyned with the thigh. 1, A veine distributed to the 7. and 9. muscles of the leg. 3, A veine conueyed to the sixt muscle of the thigh.

A, The trunk of the hollow veine below the Liuer.

aa, The roots of the same hollow veine proceeding out of the Liuer, which make the trunk thereof.

B, Another root arising out of the hollow side of the Liuer.

B, The seate of the hollow veine betwixt the Liuer and Midriffe.

C, The veine *Phrenica* or the veine of the Midriffe.

D, The orifice by which the Hollow veine groweth to the heart.

E, The crown-veine of the heart.

FF, The trunk of the veine *Azygos*.

GG, The *Intercostall* veines proceeding from the foresaide trunk.

H, The by-partition of the trunk of the hollow veine at the *Inguinum* or sticking place.

II, The *Subclavian* veine tending to the arme.

K, The vpper *Intercostall* veine.

LL, The *Mammary* veines descending.

Mr, The coniunction of the descending *Mammary* veine at M, with the *Epigastricall* veine at r.

NN, The necke veine called *Cervicalis*.

O, The veine called *Muscula*.

PP, The vpper chest veine.

Q, The double *Scapular*, or the veines of the shoulder-blade.

RR, The lower chest veine.

SS, The internall *Iugular* veine.

TT, The externall *Iugular* veine.

V, the externall *Iugular* veine diuided into two vnder the root of the eare.

X, the inner branch thereof.

Y, the outer branch thereof.

Z, A branch proceeding from the vter veine next about named, to the face.

a, the fore-head veine.

α, A branch creeping vp the temples.

* A sacle reaching to the nowle or back-side of the head.

crowne veine of the heart, because like a crowne it compasseth the Basis of the heart. This disperseth many branches through the outward surface of the heart even to the Cone or point thereof, especially on the left side, because the substance of it there is thickest and therefore needeth more Aliment.

Afterward the Hollow-veine perforateth the *Pericardium* againe, and againe groweth round but much lesse then before, and riseth vp where the right Lung is parted from the left, and so passeth to the *Iugulum*, but about the heart in the midst of the body it parteth with a notable trunk or branch to be distributed to the Spondels and the spaces between the ribs.

And this is the third branch called *Vena azygos*, or *sine pari*, that is, the vn-mated vein which we haue before called *non-pari* [tab. 5, Fig. 1, C, Fig. 2, B, Fig. 4, B] because commonly in a man it is but one, as also in dogs, and hath not another on the other side like vnto it.

It ariseth out of the backward and lower side of the hollow veine [tab. 5, Fig. 4, A] about the heart, between the fourth and fift spondell of the Chest, but more toward the right side then toward the left. In those creatures that chew the cud it is double, as also in some men (haply in those that we call *Ambidexters*, that can vse both hands alike) but very rarely, yet *Falopius* hath worthily obserued, that there is in men a left branch which doth the office of the *Vena sine pari* [tab. 7, 1], arising from the left *Subclavian* branch, and affoordeth branches to some of the distances between the ribbes. Sometimes it ariseth not out of the *Subclavian* branch,

Why some men are ambidexters. *Falopius*.

Although it shew the Trunke of the Hollow-veine disseminated thorough both the Bellies, notwithstanding it serueth especially to exhibit the distribution of the veine *Azygos*, and the coniunction of the branches thereof with the veines of the Chest, which heere is onely shewed on the right side.

TABVLA VII.

aa, The Hollow-veine from the *Iugulum* to the holy bone.

bb, The diuision of the Hollow-veine into the Iliack branches.

cc, The diuision of the hollow vein at the *Iugulum* on both sides into the *Subclavian* branches.

dd, The trunk of the veine *Azygos* which insinuateth it selfe into a branch of the hollow veine at .

ee, f, A left branch from the veine *Azygos*, inserted into the emulgent veine at f.

gg, The Kidnies.

hh, The Vreters.

i, The left vpper intercostall veine.

l, The right descending Mammary veine.

m, The internall iugular veine.

n, the externall iugular veine.

o, The veine *Muscula* going to the Muscles of the necke.

p, The diuision of the *Subclavian* branch into the *Cephalica* and *Basilica* veines.

qqq, The *Cephalica* veine cald also *humeraria*.

rrr, The *Basilica* veine, which some also call *Axillaris*.

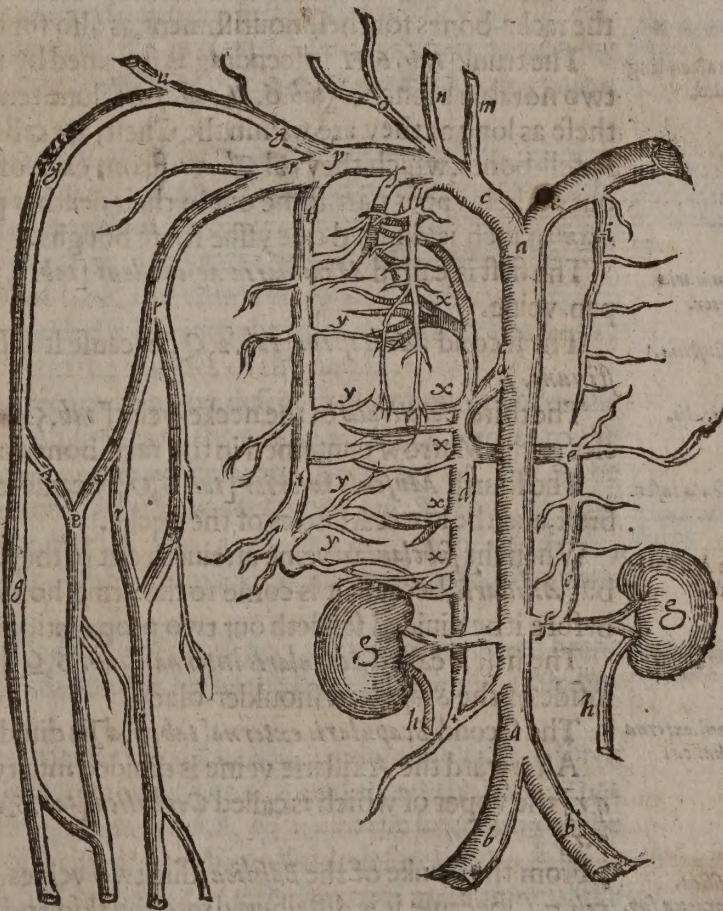
s, The vpper Chest-veine called *Thoracica*.

tt, The lower Chest-veine going to the outward Muscles of the Chest.

u, A branch of the *Cephalica* veine deriued vnto the Muscles that lift vp the arme and to the skin thereabout before it passe vnder the shoulder.

xxxx, Certain veines in the Chest from the *Azygos*, which are vnited with the outward branches yssuing from the exterior Chest-veine, which is deriued out of the *Basilica*.

yyy, The outward veines of the Chest which are vnited with the inner branches of the *Azygos*. x, A branch of the *Basilica*, which is ioyned with the *Cephalica*. A. A branch of the *Cephalica*, which is ioyned with the *Basilica*. z, B, The veine called *Mediana* or the middle veine.



but out of the trunk of the hollow veine neere the third Spondell of the Chest before the diuision thereof.

The branches of
Vena sine pari.

Commonly from the trunk of the veine *αὐγος* [tab. 5, fig. 4, B, tab. 6, FF, tab. 7, d] out of the backside of it as well on the left hand as on the right, but on the right especially, branches are distributed to the distances, sometimes of al but most what of the ten lower ribs, [tab. 5, fig. 4,] which are called *Intercoales rami* [tab. 6, GG] branches between the ribs. This vein also without his mate, affordeth many furcles to the Gullet, and sometimes neere the fourth Spondell of the Chest it sendeth a branch vppward [tab. 7, at the vpper d] from which are deriued furcles to the foure vpper ribs.

The Interco-
stall branches.

The Intercoastall branches also yeelde small strings of vessels [tab. 7, xxx] which yssue out of the chest, which are inoculated with furcles of the veine called *Thoracica inferior*, [tab. 7, yy] whence it is that we with good successe in Pleurifies open the Internall Veine of the affected side.

The diuision
of Vena
αὐγος.

The trunk of the *αὐγος* at the 8. or 9. rib is aboue the spine diuided into a right branch and a left [tab. 5, CO] which both passe downward. The left which is the larger determineth into the middle of the emulgent. The right is ioyned to the hollow veine aboue the emulgent to the emulgent more rarely, most commonly it is implanted into the last veine of the Loynes, [tab. 7, *] and hence it is that in the beginning of the Pleurifie it is profitable to open the veine in the ham or in the foote.

*Intercoastalis
superior.*

The fourth is that veine we call *Intercoastalis superior*, or the vpper Intercoastall veine [tab. 5, fig. 1, F, tab. 6, K] on each side one, arising from the *Subclavian* branch about the beginning of the Iugular veins [tab. 6, ST] and reflected vnder the Artery of the arme, and is diuided into two branches especially on the right side, which are distributed to the distances of the two vppermost ribs, sometimes to the three vppermost, and are ioyned with the Mammary branches which creepe along the gristles. [tab. 6, LL] But this veine is sometimes wanting, that is, when the vein *αὐγος* affordeth branches to al the ribs, as we said euen now that sometimes it did. Also from all the Intercoastall veins there are small tendrils which passe into the holes of the racke-bones for their nourishment, as also for the nourishment of the spinall Marrow.

The ascending
trunke.

The trunk [tab. 6, H] ascending is sustained by the Sweete-bread [tab. 3, F] and diuided into two notable branches [tab. 6, LL, tab. 7, CC] one tending to the right hand, the other to the left, these as long as they are within the Chest, are called *Rami subclauij*, because they are vnder the Patell-bones, which they call *Claues*. From each of these *Subclavian* branches, some veins spring out of their vpper part, some out of their neather part. From the lower part before the *Subclavian* branch is diuided doe yssue foure boughs.

*Mammaria
inferior.*

The first is called *Mammaria descendens* [tab. 5, fig. 1, EE, tab. 6, LL, tab. 7, I] the descending pap-veine.

Mediastina.

The second *Mediastina* [tab. 2, Q] because it is Disseminated especially through the *Mediastinum*.

Cervicalis.

The third *Cervicalis* or the necke-veine [tab. 5, OO, tab. 6, NN] because it communicateth furcles to the Marrow contained in the rack-bones of the necke.

Muscula infer.

The fourth *Muscula inferior* [tab. 6, O] because it is distributed into the vpper Muscles of the brest, and the lower Muscles of the necke.

The Axillarie
veine.

When the *subclavian* veine attaineth out of the Chest [tab. 7, P] it is called no more *subclavia* but *Axillaris*, because it is come to the arme-hole called *Axilla*. The Axillary veine therefore before it be diuided sendeth out two propagations.

Scapul. interna

The first is called *Scapularis interna* [tab. 6, Q] because it is dispersed to the Muscles on the inside of the *Scapula* or shoulder-blade.

*Scapul. externa
Cephalica.*

The second *Scapularis externa* [tab. 6, d] is diuided to the outside of the blade. Afterward the Axillarie veine is diuided into two branches, [Tab. 5, HL, tab. 6, a m, tab. 8, q r] the vpper of which is called *Cephalica* [tab. 6, a, tab. 7, q] the lower *Basilica*. [tab. 6, m, tab. 7, r]

*Basilica.
Thoracica sup.*

From the trunk of the *Basilica* issue two veins. The first called *Thoracica superior* [tab. 6, PP, tab. 7, f] because it is distributed into the skin and Muscles which couer the chest.

Thoracica infe.

The second *Thoracica inferior* [tab. 6, RR, tab. 7, ti] because it runneth along the side of the chest, and the branches of this veine are inoculated [tab. 7, yy] with the furcles of the Veine *αὐγος*. [tab. 7, xxx]

Muscula supe.

From the vpper part of the *Subclavian* veine three veins doe arise.

The first is called *Muscula superior* [tab. 7, o tab. 6, bb] because it is distributed into the muscles and skin on the backside of the necke.

The

The second *Inguularis externa* [tab. 5, fig. 1, LL, tab. 6, TT, tab. 7, n] is commonly on each side one, but sometimes double, and is againe diuided vnder the root of the eare.

The third *Inguularis interna* [tab. 5, fig. 1, KK, tab. 6, T T, tab. 7, m] is greater in a man then it is proportionably in other creatures, because a mans braine is greater; iust at the head it is diuided.

But because al these veines we must handle more accurately in our Book of the vessels, it shal bee sufficient here onely to haue named them and shewed them vnto you, wee proceed to the Nerves.

CHAP. X.

Of the Nerves in the Chest and the Necke.

THe Nerves disseminated through the Chest and the Necke are of two sorts, yet all proceeding from the marrow of the braine; the first sort whilest the marrow is in the skul, the other after it is in the racke bone, and is called *spinalis medulla*.

Out of the marrow yet in the skul, the sixt paire come. [tab. 8, fig. 1, ee] They seeme to be but one nerue, but indeed are two inuested with one membrane, and passe out at a hole betweene the nowle and the temporall bones. The *anterior* and lesser part of this nerue is disseminated into the muscles of the tongue and into the mouth. The *posterior* and greater sendeth branches to the muscles of the neck, [tab. 8, fig. 1, f] to the second moouing the shoulder blade, and descending more inward to the muscles that are in the cavity of the *larynx* or throtle [tab. 8, fig. 1, q] some slender ones also to the muscles of the bone *Hyois*.

Above the *Inguilum* or Region of the Coller-bone before it enter into the Chest, this branch is diuided into two [tab. 8, fig. 1, b] boughes, the one outward and the greater, the other inner and the lesse.

The outward bough maketh the recurrent nerves, found out first by *Galen*. They are also called the voell nerves, because if they be wounded, the creature loseth his voyce as we haue often tryed in the dissection of liuing Dogs, for if one be cut or tyed he loseth halfe his voyce, if both, he loseth it wholly.

The outward branch of the right nerue presently after the diuision [tab. 8, fig. 1, b] sendeth furcles on both sides [tab. 8, fig. 1, KK] to the muscles arising from the brest-bone and the *Clauicles* or coller-bones; and presently when it commeth to the *Axillary* artery [tab. 8, fig. 2, P] it transmitteth as it were about an Axle-tree [tab. 8, fig. 2, P] three branches from the inner side [tab. 8, fig. 1, l] which being reflected toward the head and vnited do make the right recurrent; [tab. 8, fig. 2, Q Q and fig. 1, m] and it is inserted with the left into the second gristle of the *larynx* [tab. 8, fig. 1, n] and implanted into the *glottis* and the muscles of the *larynx*.

The foresaid branch after it hath made the recurrent nerue, descendeth obliquely vnder the coller-bone, and in the way outwardly affordeth furcles to the *pleura* [tab. 8, fig. 1, qq] & to the coat of the lungs, inwardly to the *Pericardium* or purse of the heart [tab. 8, fig. 1, t] and to the heart it selfe, and then maketh the nerue called *Stomachicus dexter* or [tab. 8, fig. 1, se] the right Stomacke nerue which reacheth ouer to the left side, as the left doth to the right side, and so at length is consumed into the left orifice of the Stomacke, whence it hath his denomination.

The inward branch of the right nerue is called *Costalis* [tab. 8, fig. 1, iiz] which affordeth branches to all the bowels of the lower belly, and reacheth as far as the holy-bone, and is distributed into three branches.

The first [tab. 8, fig. y] creepeth to the lower membrane of the kell, & is subdivided into three small branches, whereof one goeth to the collick gut [tab. 8, fig. 1, z] and this is the reason that after a long fit of the collicke men grow hoarse; another [tab. 8, fig. 1, a] to the beginning of the guts which is so small, that it can hardly be perceiued. The third affordeth furcles [tab. 8, fig. 1, s] to the bottome of the stomacke: on the right side thereof, and to the vpper membrane of the kell, the rest of it is spent in the coat of the Liuer [tab. 8, fig. 1, v] and the bladder of gall. The second and the lower [tab. 8, fig. 1, d] reacheth to the right kidney, and hence it is that men vomit in fits of the stone.

The third which is the greatest [tab. 8, fig. 1, e] passeth to the Mesentery and the guts. The rest descendeth directly to the bladder. [tab. 8, fig. 1, s]

Inguularis externa

Inguularis interna

The sixt paire of sinewes.

The recurrent nerves.

The right nerue of the 6. coniugation.

Stomachicus dexter.

Costalis hath 3 branches.

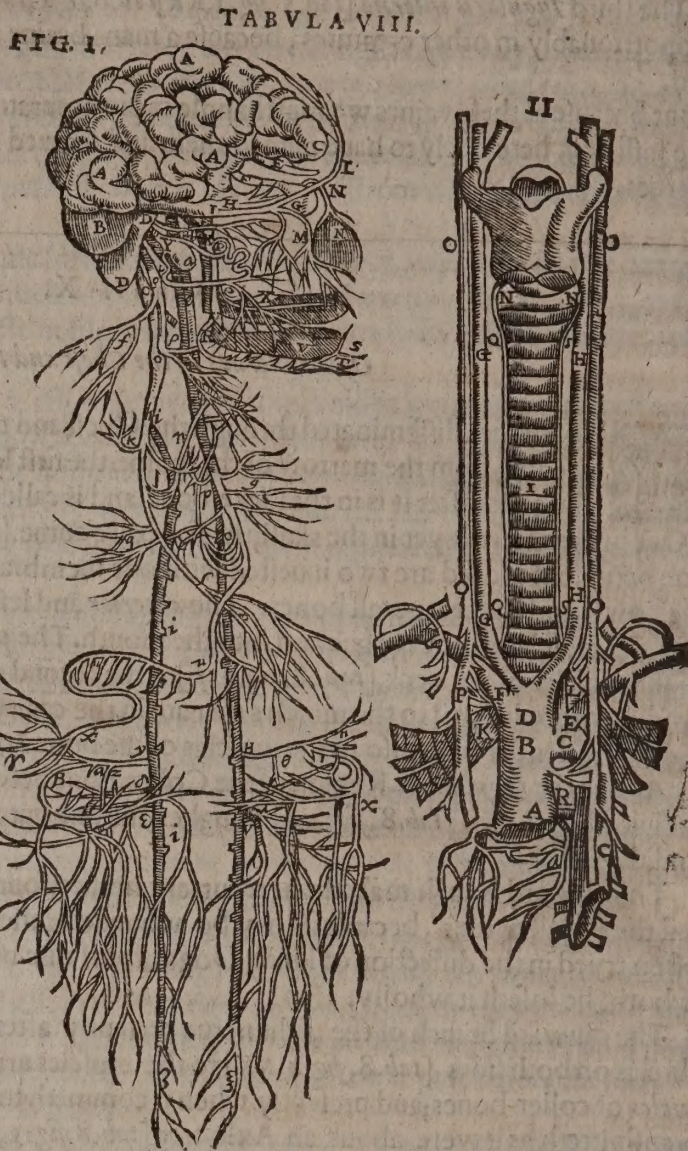
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Table 8. Figure 1. sheweth the Braine and the after-Braine or Cerebellum together with the Nerves (as the common opinion is) proceeding out of them: and this Table we have especially set in this place to shew the distribution of the Nerves of the sixth coniugation through both the bellies.

A, The Braine.
 B, The Cerebellum or after-braine.
 C, A proesse of the braine, but not that which is called *Mammillaris*.
 DD, The marrow of the back as it is yet within the skul.
 E, The *Mammillary* proesse or instrument of smelling.
 F, The opticke nerve. (spread.
 G, The coate of the eye into which the opticke nerve is
 H, The nerve that moveth the eye or the second payre.
 I, The third coniugation, or the harder & lesser branch
 of the nerves of the 3. coniugation brought forward.
 K, The fourth coniugation or the greater and thicker
 nerve of the third payre bending downward.
 L, A branch of the nerve marked with I, which goeth
 to the fore-head. (iaw.
 M, Another brāch of the nerve I, reaching to the vpper
 NN, A nerve proceeding from the branch I, intexed
 or wouen with the coate of the nose.
 O, The nerve of the temporall muscle issuing from the
 P, A nerve contorted of the nerves K, & b. (branch I.
 Q, A nerve proceeding from the branch K, to the soc-
 cets of the vpper teeth.
 R, A nerve creeping from the nerve K, to the lower iaw.
 S, A surcle of the branch R, offered to the lower lip.
 TT, Other surcles from the branch R, attaining to the
 lower teeth.
 VV, A branch of the nerve K, diffused into the coate of
 the tongue.
 XX, The fourth paire of sinews which goe into the coat
 of the pallat.
 Y, the 5. paire of sinews which are the nerves of hearing
 a, the membrane of the eare, vnto which that fift nerve
 goeth.
 bc, two small branches of the fift coniugation vnting
 themselves with the nerve P.
 d, the eight coniugation or a nerve of the fift paire at-
 taining vnto the face.

ee, the sixt paire of nerves. f, A branch from the nerve e, reaching to the muscles of the neck. g, Small branches deriued vnto
 the throtle or larynx. h, the byfurcation of the nerve into two branches. iii, An inner branch hanging to the rack-bones,
 and strengthening the *intercostall* nerves, and is therefore called *Intercostalis*. kk, Surcles of the viter branch going to the heads
 of the muscles, to the breast-bone and to the collar-bones. lm, branches of the right nerve I, making the right Recurrent
 nerve. mn, the insertion of the Recurrent sinews into the muscles of the larynx. op, Branches of the left nerve o, making the
 left Recurrent sinew p. qq, Branches from the sixt coniugation going to the coat of the lungs. r, Small nerves of the heart &
 of the purse thereof called the *Pericardium*, as also some approaching to the coates of the lungs. s, nerves on either side sent
 to the stomack. t, the right stomacke nerve going to the left orifice of the stomack. uu, the left stomack nerve going to the
 right orifice of the stomack. x, A nerve from the branch u, passing into the hollownes of the liuer. y, the nerve belonging to
 the right side of the kell. z, the nerve belonging to the collick gut. a, A nerve creeping to the gut called *duodenum* and the
 beginning of the *icium* or empty gut. β, A nerve implanted in the right side of the bottome of the stomack. γ, A nerve
 belonging to the Liuer and bladder of gall. δ, A nerve reaching vnto the right kidney. ε, A branch reaching the *Mesente-*
rium and the guts. ζ, A branch sprinkled to the right part of the bladder. η, A branch going through the left part of the kel.
 θ, Surcles deriued to the collick gut and the kell. x, Small branches inserted into the spleene. λλ, A nerve approaching to the
 left side of the bottome of the stomack. μ, A branch belonging to the left side of the *Mesentery* and the guts. ν, A branch
 which attaineth to the left kidney. ξ, Small nerves creeping through the left side of the bladder. o, The 7. paire of sinews. π, A
 branch deriued from the sixt coniugation to the muscles which arise from the proesse called *Styloides*. ρ, A branch of the 7
 coniugation which goeth to the muscles of the tounge, of the bone *hyois*, and of the throtle or larynx. σ, A coniunction or
 coition of the 6. and 7. paire into one nerve.

Figure 2. exhibiteth the Recurrent sinews together with a portion of the great Artery and the rough Artery called the *weaz on*.
 A, The orifice of the great artery cut from the heart. aa, The coronall arteries. BCD, The diuision of the great artery into two
 trunks, the descending C, the ascending D. E, the left *Axillary* artery. F, The right *Axillary* artery. G, the right *Carotis* or slee-
 py artery. H, the left *Carotis*. I, the trunk of the rough artery. KL, the diuision of the rough artery. M, the head of the rough
 artery called the larynx or throtle. NN, Certaine glandules or kernels at the root of it. OO, the right and the left nerves. P, a
 reuolution of small branches of the right nerve to the right axillary artery. QQ, the right Recurrent nerve. R, a reuolution of
 small branches of the left nerve to the descending trunk of the great artery. SS, The left recurrent sinew.



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The left Nerue of the sixt coniugation [tab. 8. fig. 1. e, fig. 2 o] is diuersified after the same manner with the right, and when it attaineth to the collar, is diuided into an outward and an inward branch. The outward communicateth it selfe to the *Pleura* [tab. 8. fig. 1. q] and the coats of the Lungs, and descending to the trunk of the great artery [tab. 8. fig. 1. c] transmitteth commonly three small furcles, which being reflected and vnited [tab. 8. fig. 1. R] make the left recurrent Nerue. [Table 8. fig. 1. ss] The remainder of this outward bough enclining to the right hand maketh the Nerue, which they call *Stomachicum sinistrum*, the left Stomacke Nerue [Table 8. fig. 1. uu] which vnder the gullet is ioyned with the right Stomacke Nerue. [Tab. 8. fig. 1. f]

The left nerue of the 6. coniugation.

The left Recurrent.

The inward bough of the left Nerue passeth through the chest where it maketh *Sinistrum costalem*, the left Rib-nerue, & vnder the Midriffe is diuided into three branches. The first and vppermost [tab. 8. fig. 1. n] goeth to the Kell, from which doe proceede two smal furcles, one to the collicke gut [tab. 8. fig. 1. o] and the lower Membrane of the Kell; [tab. 8. fig. 1. r] the other to the bottome of the stomacke [tab. 8. fig. 1. aa] and the vpper Membrane of the Kell; that branch which remaineth is inserted into the Splene. [tab. 8. fig. 1. x]

His inward bough diuided into three.

2. The second [tab. 8. fig. 1. u] runneth to the left side of the mesentery, and vnto the guts thereabout, and sometimes some furcles there-from accompany the Seminary vessels euen to the Testicles.

3. The third [tab. 8. fig. 1. v] attaineth to the left Kidney: the remainder of the whole branch is consumed in the left side of the bladder. [tab. 8. fig. 1. z]

And thus much of the diuication or distribution of the Nerues from the sixt coniugation which yssue from the marrow of the braine contained within the scull.

The Nerues that yssue out of the marrow of the braine after it is contained in the Spondels of the backe, and is commonly called *Spinalis medulla* are of two sorts, some of the Necke, others of the chest.

Two sorts of Nerues.

Of the Nerues of the Necke there are seuen pairs, and from the three last proceedeth one branch called the Midriffe-Nerue, made of three furcles all dispersed into the *Diaphragma* or Midriffe.

Cervicales pairs seuen.

Of the Nerues of the chest there are 12. paire called *Intercostrales Nervi*, because they pertain to euery distinction between the ribs, & runne close to the bone on the lower side thereof all along the length of it, for in the bottome of the rib there is a cavity where the Artery Vein and Nerue doe meete; and therefore when you shall open a mans side diseased of the *Empyema*, you must make your incision at the vpper part of the Rib.

Thoracice pairs 12.

A note how to make incision in the *Empyema*.

And this shall suffice to haue spoken of the Nerues belonging to the Chest at this time and in this place, the more accurate Discourse you must looke for in our Booke of the Vessels.

CHAP. XI.

Of the Heart.



He Heart is a principall part; not as *Aristotle* called it principall, who placed in it all the actions of life and sense; but as being the fountaine of the Vitall Faculty and spirit, the place and nourishment of naturall heat, whereby the naturall heate of all the parts is preserved, and by his influence repaired; the seate of the Irascible or angry part of the soule, the root of the Arteries and Author of the Pulse.

It is called *Cor à currendo*, because it seemeth continually to run, for that it is continually moued. The Greekes call it *καρδιά*, either of a word which signifieth to beate or pante, which is our proper word for the beating of the heart; or from a word which signifieth a Bakers moulding-board, because in it the alimentary blood is as it were kneded, wrought, moulded, and driuen out into thinnesse, till it turne into a vitall spirit; or finally from a word which signifieth principality, because it is a principall part as well as the braine; yet so that as the Braine is of greater dignity, so the heart is of greater necessity; for the least hurt of this most what causeth death; and *Galen* saith, that death neuer happeneth but when the heart is immoderately distempered. Whereupon also *Aristotle* saith, There was neuer any liuing creature seene without a heart, because without it there can be no Originall at all of heate.

Names.

The necessity of the Heart.

Is

It is situated in the midst of the cavity of the chest in a Noble place as it were a Prince; and after the manner of those which being but one do occupy the midst as well for security, as that the body may be equally ballanced. At the fifth rib it is embraced by the Lobes of the Lungs as it were with fingers [tab. 3. NOPQ: Tab. 9, fig. 1, and 2, tab. 10, fig. 1, and 2,] round about, that equally out of all the Lungs, it might draw breath by the venall Artery, and might againe deliuer ouer and diffuse blood by the arteriall veine, and life and heat by the great Artery to all the outward parts; and it is locked vp in his owne Capcase [tab. 9, fig. 1, DEF: Fig. 2, BB] but so that the Basis resteth exactly in the midst, whether we regard the right hand or the left, the fore-part or the back, the vpper or the lower; but the point [tab. 9, fig. 2, E] reacheth to the left hand, yet forward as farre as the left Nipple, so that in a liuing man it looketh directly forward (with a kinde of strutting position) to the Gristles of the sixth and seventh ribs of the left side where they are ioined to the brestbone, that it may the better warme the fore-part against which we moue. And truly it behoued that it should encline to one side that it might giue way to the Midriffe, and so neither of their motions (which are both perpetuall) should be hindred; but not vnto the right side, for that the hollow veine takes vp as he ascendeth thorough the chest; happily also Nature was heere of *Aristotles* minde in the 4. Chapter of his 3. Booke *de partibus Animalium* (for he was often of hers) that the left side was the colder and therefore she placed this hot part in it; for on the right are the hollow veine and the *Non-paril*, which heate it sufficiently; and so both sides are provided of heate and strength alike. Notwithstanding the common people are deceiued, who thinke it lyeth wholly on the left side because the motion and pulsation is most felt on that side, when indeede it lyeth in the verie midst, as in the more Noble place; but the left ventricle which is the Store-house of spirits and the great Artery were the cause of their error, as *Galen* sayth in the second Chap. of his first Booke *de usu partium*. Adde heereto, that in dead carkasses it is drawne somewhat to the left side, partly by his owne waight, partly by the waight of the great artery which is fastned vnto it.

His connexion It is tied by the mediation of the *Pericardium* or purse to the *Mediastinum* [tab. 9, fig. 1, from F to G] and to the Midriffe, as also by his vessels to other parts. For *Galen* saith, that principals in some things are to be tyed together, and communicate one with another: otherwise it is loose, that it may mooue the more freely.

His Figure: The figure of it as *Hippocrates* saith in his Booke *de Corde* is *Pyramidall*, [expressed so in the table 9, fig. 2,] or rather turbinated & somewhat answering to the proportion of a Pine Apple, because a man is broad and short chested. For the Basis aboue [tab. 9, fig. 2, CD] is large and circular but not exactly round, and after it by degrees endeth [tab. 9, fig. 2, E] in a cone or dull and blunt round point; for such a figure was fittest for his function, because length maketh much for traction or drawing, and roundnes for amplitude and strength: so in great dilatations it is sphericall that it might hold more; and in his contractions long and as it were *Pyramidall*, especially in brute beasts.

The names of the Basis. His superior part which is called the basis, the head, and the roote [tab. 9, fig. 2, CD] is broader because of the vessels which in that place haue ingate and outgate, haply also because of his motion, that in this broad Basis the excauations or cauities might be the larger, that when it is contracted both kindes of Blood arteriall and venall might haue place and room to retire to, and not be too vehemently wrought or pent vp in too straight a roome, least it should violate the continuity of his substance or of the fibres therein.

The names of the lower end. His lower part is called the *Vertex* or top, *Mucro* or point, the *Cone*, the height of the heart. *Hippocrates* calleth it the taile [tab. 4, fig. 2, E] which *Galen* saith in the 7. chapter of his 6. Booke *de usu partium* is the basest part, as the Basis is the noblest. Before the heart is gibbous or bunched, behind hollow and in the sides prominent. The Superficies or surface of it is smooth and polished all ouer, were it not that in some places the Fat, in other the Coronary vessels strutting with blood, did make it vnequall.

His quantity or magnitude. His quantity or magnitude is not alike in all, and in a man proportionably (as also the braine and the liuer) greater then in other creatures being as long as the breadth of 6. fingers and foure broad, and so many high. But in fearefull creatures as the Hare, Hinde, Ass and such like it is proportionably very great, for the heat when it hath too much scope or roomth (saith *Aristotle*) is easily dissipated and vanisheth.

The parts of the Heart. Externall. The parts of the Heart are some externall, others internall. The externall are the Purse, of which wee haue already spoken, the coate, the fat, the vessels which are of two sorts, some which encompass the Heart, others which reach vnto the entrances into his Ventracles and the

the ears. The in
Values or Flood-g
The coate is pro
compaseth the M
substance from wh
with *Galen* and A
Gue, especially a
Gone celebrated of
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then *Praguedo*, an
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Table 9. figure 1. sheweth the heart included within his purse or Pericardium, together with the Lungs and a part of the Midriff.

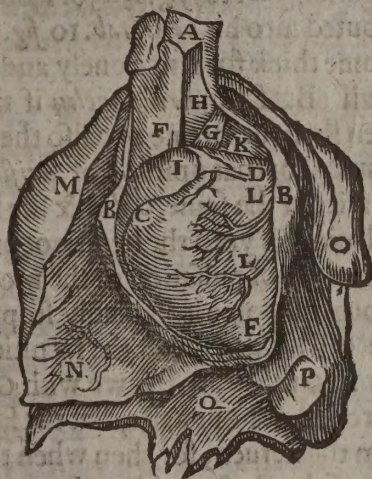
Figure 2. sheweth the Pericardium opened, and so the situation of the hart and particularly the fore part thereof.

TABVLA IX.

FIG. I.



FIG. II.



- A, A portion of the ascending trunk of the hollow Veine.
- a, A portion of the Great Artery.
- B, The beginning of the Pericardium, cleaving very close to the hollow veine, vnto the Arteriall vein and to the Great Artery.
- C, The small Veines of the Pericardium or Purse of the heart.
- DE, The foreside of the Pericardium bearing the figure of the basis of the heart.
- F, The sharpe end of the Pericardium. From F, to G, the connexion of the Pericardium with the midriff.
- H, A part of the Septum transversum or the midriff.
- II, His Nerues.
- L M N O, The foure Lobes of the Lungs.

The second Figure.

- A, The place where the Pericardium is continued with the vessels of the heart.
- BB, The Pericardium reflected to the sides.
- CD, The Basis of the fore-part of the heart.
- E, The point of the fore-part of the heart called *Mucro*.
- F, The Hollow Veine.
- G, The Arteriall Veine.
- H, The great artery & the venall artery, which cannot be scene vnlesse the heart be leaned to the left side.
- I, The right eare of the heart.
- K, The top of the left eare.
- L, The coronary or crown-veine and artery of the heart.
- LL, Certaine branches proceeding from these vessels.
- M N O P, The foure Lobes of the Lungs.
- Q, A part of the Midriff.

the eares. The inward parts are the fleshy substance and the Fibres, the Ventricles and the Values or Flood-gates.

The coate is proper to the heart, very thin and fine. *Vesalius* likens it to the Membrane that compasseth the Muscles, this inuesteth it as that of the Muscles, and so strengtheneth his substance from which it cannot be seuered. The fat called *Pinguedo* with *Columbus*, or *Adeps* with *Galen* and *Aristotle* or both with *Archangelus*, very plentifully gathered about it like Glue, especially at the Basis where the greater vessels are placed, because there is the condition celebrated of those things that are contained in it, and not in the Cone or point. This fat is harder then it is in any other part; and therefore it should seeme rather to bee *Adeps* then *Pinguedo*, and that is *Galen*s and *Aristotle*s reason; for if it were *Pinguedo* it would melt with the extreame heate of the heart to great disadvantage. Howsoeuer the vse of this Fat is to moysten the heart, least being ouer-heated with his continuall motion it should grow dry and exiccated, but this kinde of fatty humidity is hardly consumed, but remaineth to cherish it, and to annoynt and supple the vessels that they cleaue not with too great heate and drought.

Moreouer, the heart being the fountaine of heate which continually flameth, it serueth for a sufficient and necessary Nutrimment whereby it is cherished and refreshed, and in great affaishments nourished and sustained; least otherwise the heart should too soone depopulate and consume the radicall moysture. Wherefore *Galen* ascribeth this vse to fat, that in great heates, famins, & violent exercises, it should stand at the stake to supply the want of nature at a pinch.

So

The Coate

The vse of fat

A substance
like fat obser-
ued in the ven-
tricles of the
heart.

The veine cal-
led *Coronaria*.

What nourish-
ment the heart
needed.

The Arteries.

By what spi-
rits the heart
liueth.
The nerues.

Archangelus his
conceit that the
motion of the
heart commeth
from his nerues

A cause of sud-
den death.

So saith *Auicen*, Fats of all kinds are increased or diminished in the body according to the increase or diminution of heate, wherefore heate, feedeth vpon them. We haue often obserued in opening of the ventricles of the heart, in the very cauities of them a certaine gobbet or morsell if not of Fat yet of a substance very like it, so that we haue more wondred how that should in such a furnace congeale, then the other in the out side. The cone is alwaies moystened by the humor contained in th *Pericardium*.

The vessels of the heart are of all kinds, which doe compass the heart round about. [Table 9. fig. 2. l & branches from these, LL, tab. 10. fig. 2. D] The veine is called *Coronaria* or the crown veine arising from the trunk of the hollow veine [tab. 6. E] before it be inserted into the right ventricle, and sometimes it is double: this engirteth round like a crown the basis of the heart, and hath a valve set to it, least the blood should recoil into the hollow veine.

From this crown veine are sprinkled branches downward along the face of the heart, which on the left side are more and larger, because it is thicker & more solid then the right side. This bringeth good and thicke blood, laboured onely in the Liver to nourish this thicke and solid part, that the Aliment might be proportionable to that it should nourish. By this vessell also it may be beleued that the Naturall Soule residing in the naturall spirit is brought into the heart with all his faculties.

It hath also two arteries called *Coronarias* [tab. 12. fig. 1. BB] proceeding from the descending trunk of the great Artery, which together with the veine are distributed through his substance to cherish his in-bred heate, and supplying vitall spirits doe preserve his life: for if the heart did liue by the spirits perfected in his left ventricle and carried vnto his substance without arteries, then also might the same spirit passe through the pores of the heart and so be lost.

It hath also Nerues but very small ones from the 6. coniugation [tab. 10. fig. 1. K] or from the nerues which are sent vnto the *Pericardium* which are distributed into his *basis* [tab. 10. fig. 2. h] close by the arteriall veine, but not very precious; and as some think for sence onely and not for motion, because his motion is Naturall and not Animall. But saith *Archangelus* if there must be but one and not two principles of motion in vs, then shall the Braine bee also the originall of all motions, because it is the seate of the sensible Soule, (for that opinion of *Aristotles* who attributeth vnto the heart only all the powers and faculties of the soule, *Galen* & the later writers do with one consent disauow) and so this nerue shall minister vnto the heart not onely sence but also motion and both their faculties, and also the faculty of pulsation or the motion of dilatation and constriction. And this nerue sometimes though seldome is suddenly stopped, whence commeth hasty and v unexpected death, which we call sudden death, the faculties of life and pulsation being restrained so that they cannot flow into the heart. But we with *Galen* in the 8. chap. of his 7. Book *de Anatom. Administ.* will determine for our parts, that the faculty of pulsation ariseth out of the body of the heart not from the nerues; for then when these are cut away, the pulse should cease; and the heart taken out of the chest could not be moued, which we find otherwise by dissection of liuing creatures.

CHAP. XII.

Of the substance, ventricles and eares of the Heart.



He substance of the Heart is a thicke [tab. 10. fig. 3. sheweth this] and red flesh, being made of the thicker part of the blood; it is lesse red then the flesh of Muscles but harder, more solide and dense, that the spirits and inbred heate which are contrayned in the heart and from thence powred into all parts of the body should not exhale; and that it might not be broken or rent in his strong motions and continuall dilatation and constriction. And it is more compact, spisse & solid in the cone then in the *basis*, because there the right fibres meeting together are more compact, right as it is obserued in the heads or tendons of the muscles. This flesh is the seat of the vital Faculty and the primary and chiefe cause of the functions of the heart, which consist especially in the making of vitall blood and spirits. For it hath al manner of fibres right, oblique and transuerse, most strong and most compact and mingled one with another (and therefore not conspicuous as in a muscle) as well for the better performance of his motion, as for a defence against iniuries; wherefore according to the opinion of *Gal* in the 6. chap. of his 3. Book *de motu muscul.* & in the 7. chap. of his 8. Book *de v. s. p. art.* (who sometime calleth it after the common name of the bowels a

Where is the
seat of the vi-
tal faculty.

The heart hath
al kind of fi-
bres.

PAYEN-

Parenchyma; sometime the fleshy bowell) it is not a muscle, because it hath all kinde of fibres and is not moued with a voluntary motion, for after *Galen's* determination a muscle is the instrument of voluntary motion: but the motion of the heart which dependeth vpon his substance and flesh is not Voluntary but Naturall, neither can cease so long as the Creature liueth; but the action of the muscles resteth sometimes and is againe set on worke according to the determinate purpose of the Creature to which it is obedient. Notwithstanding *Hippocrates* in his Booke *de Corde* calleth it a very strong muscle and not vnworthily; for he defineth a muscle to bee flesh rowled into a globe, and such is the flesh of the heart: wherefore both of them resting vpon their owne definitions haue deliuered the trueth. And therefore *Picholomeny* answered for *Hippocrates* that there is in vs one motion Natural whose muscle is the heart; another motion voluntary to which all the other muscles of the bodye are obedient; and he maketh a generall definition of a muscle, that it is a fleshy instrument working motion in a creature: vnder which the heart also may be contayned.

The perpetuall motion of the heart because of the continuall generation of spirits (because euery part standeth in neede of them) is double consisting of a *Diastole* or dilatation, and a *Systole* or contraction, which is accomplished by the fibres: for as long as the Creature liueth it is dilated and contracted, and betwixt either of these motions commeth a rest or cessation: for contrary motions, saith the Philosopher, cannot be without a rest between them.

It is dilated when the cone or end is drawne to the *basis* with right fibres, and then it becommeth short indeed, but his sides are so distended that it appeareth sphericall or round. The vse of this motion is to drawe blood into the right ventricle by the hollow veine, and ayre into the left by the venall artery, the valves falling downe and giuing way to their entrance; but it is contracted when the cone or poynt departeth from the *basis*, and then the heart becommeth longer indeed but narrower, the right fibres being loosed to their length, and the transuerse which encompasse the heart round being strongly gathered together and straightned, the valves of the hollow veine and the venall arterie partly shutte, but those of the great artery and the arteriall veine are opened, yeelding out-gate to the blood out of the right ventricle by the arteriall veine into the Lungs, and to the vitall spirit out of the lefte ventricle into the great artery, and to a portion of the vitall blood together with the soote through the venall artery. This motion of the heart is called *Systole* or contraction and depression.

This contraction is not a little helped, if not altogether performed, by certayne strong ligaments [*Tab. 10. fig. 6. L, fig. 9. H H*] which are stretched in the inmost parts of the ventricles of the heart; for when these being contracted doe fall, they also drawe ogethether with them the coats of the heart inward.

Finally the oblique fibres which ly obliquely along the length of the heart, are the cause of the small rest that is betwene these contrary motions; and those things whether blood or spirits, which are drawne into the heart by their helpe are a little while reteyned in the ventricles, the heart being on euery side straightned about those things it conteyneth: but if in the dissection of a liuing Creature you carefully obserue the motion of the heart, you shall discerne foure motions distinguished by their seuerall times and places, whereof two are proper to the eares of the heart, and two to the ventricles. The cauities of the heart which we call ventricles, *Hippocrates* called *γαστρίαι*, i. Bellies, so doth *Galen* in the 11. Chapter of his 6. Booke *de vsu partium*, but by a diuerse name *κοιλία*. They are two very notable differing in largenes and in forme.

The right [*Tab. 10. Figure 3. G G*] is not exactly round, and hath a proper superficiall circumscription of his owne, semicircular and crescent like a halfe Moone, for the belly of the partition which is like a semiorbe stands out into it. This, sayeth *Hippocrates*, compasseth *Caudam cordis*, that is, the taile, he meaneth the poynt or cone of the heart, but reacheth not to the very extremity, yet lower sayeth *Vesalius* then the left ventricle doth. It is broader also and larger much then the other, because it is to containe a farre greater quantity of blood, therefore *Galen* in the 7. and 12. Chapters of his sixt Booke *de vsu partium* and an ancient Greeke Physitian of *Ephesus* called *Ruffus*, call it the bloody ventricle and *venosus*, that is, the veiny ventricle. His flesh is more laxe and soft and his partition thinner [*Tab. 10. figure 5. 2 R*] in compensation of the waight of that it contayneth, that the heart might not be over-ballanced. Into this the ascending hollow veine whilest the heart is dilated powreth blood, that in the dennes which are among the fibres of it, it might by the heate of the

How *Hippoc.* is to be understood when he calleth the heart a muscle.

The double motion of the heart. Contrary motions must haue a rest betwene them.

How the heart is dilated.

How it is contracted.

Ligaments in the heart help or author of contraction

The rest of the heart how wrought.

4. Motions in the hart distinguished by their times and places.

The right ventricle.

- Table 10. Fig. 1. sheweth the right side of the heart freed from the Pericardium or purse, which together with the Lung is reflected to the left side, that the continuity of the Hollow veine with the heart at his basis might better be discerned, together with the vessels and a part of the Midriffe.
- Fig. 2. sheweth the heart turned upon the right side, that so the left side and the Venall Artery with his Nerue might better be discerned.
- Fig. 3. sheweth the heart cut overthwart that the thiknesse of the ventricles might better appeare.
- Fig. 4. sheweth the bones of the heart as some expresse them.
- Fig. 5. sheweth the heart freed from the Lungs and the midriffe, the right ventricle and the orifice of the hollow-veine dissected.
- Fig. 6. sheweth the heart cut thorough the right ventricle and the orifice of the Arteriall veine.
- Fig. 7. sheweth the heart cut through the left ventricle, as also the orifice of the venall Artery cut open.
- Fig. 8. sheweth the heart cut through the left ventricle and the orifice of the great Artery.

TARVLA. X.

- A, The right side of the heart, and a great part of the back side.
B, The right eare of the heart.
C, The hollow veine opening into the heart, from which place Aristotle thought it tooke his originall.
D, sheweth the place where the Hollow-veine passeth through the Diaphragma or Midriffe.
E, A part of the Diaphragma or Midriffe.
F, The hollow-veine tending to the Jugulum.
G, The beginning of the veine Azigos.
H, The trunk of the great Artery, where it descendeth.
K, A part of the Nerue of the sixth coniugation, from which the heart getteth a Nerue.
L M N O, The four Lobes of the Lungs.
P, The way of the Vessels which attaine to the Lungs.

II. Figure.

- ABC, The left side of the heart, & a great part of his back side.
D, The vessels of the heart which compasse his Basis.
E, The branches of the same vessels.
F, The left eare of the heart.
GH, The venall Artery, his distribution into the left Lung.
I, The Arteriall veine.
K, His branch going to the left Lung.
L, His branch going to the right Lung.
M, The top of the right eare of the heart.
NN, The hollow veine.
O, The trunk of the great artery.
P, His descending trunk.
Q, The left Axillary artery.
RS, His ascending trunk.
T, The right axillary artery.
UV, The Carotides or sleepey arteries called also *Soporiae*.
W, The trunk of the Veason or rough artery.
X, The right nerue of the sixth paire.
Y, Certaine branches making the right Recurrent sinew f.
Z, The left Nerue of the sixth paire.
a, Certaine branches making the Recurrent Nerue.
b, A sinew of the same offered to the left Lung.
c, The left Recurrent Nerue.
d, A small Nerue attaining to the Basis of the Heart.
e, The Lobes of the Lungs.
f, The Midriffe or Diaphragma.

III. Figure.

- ACD, Portions of the vessels of the heart.
B, The right eare of the heart.
E, The left eare of the heart with a part of the Venall artery.
F, The point of the heart called the Cone and *Mucro*.
GG, The right ventricle of the heart.
HH, The left ventricle of the heart.
II, The partition called *Septum* which distinguisheth the Ventricles.

IV. Figure. and V.

- AB, A part of the Hollow-veine from the Midriffe to the Jugulum. CCC, The orifice of the hollow-veine opening into the right Ventricle. DE, The orifices of the descending and ascending hollow veine. F, The rugous or vnequal inside of the right eare of the heart, which is placed in the left side, because the heart is dissected through the midriff. G, The beginning of the Crown-veine of the heart. HHH, A circle bunching out in the orifice of the hollow veine. KLM, The 3. Values of the hollow veine. NN, The Filaments or Fibres of the Values. OO, Certaine fleshy excrescencies to which these Filaments do grow. P, A cavity regarding the orifice of the arteriall veine. QR, A part of the heart compassing the right ventricle. V L, Figure. AB, A portion of the hollow veine and the great Artery. CD, The orifice of the arteriall veine, the mouths also of his two branches. EFG, The three Values or Flood-gates, to which those Filaments are impanted. M, the right eare of the heart inuerted and hanging downe. Fig. 7. A the trunk of the great Artery. D, A portion of the arteriall veine. CC, The orifice of the venall artery. DD, A bunching circle in the same orifice. EF, The two Values of the venall artery. GG, Filaments drawn downward from the Values HHH. The fleshy portions to which they are fastned. I, The left eare of the heart turned inward. K, The wall of partition betwixt the ventricles. L, A boosome or cavity reaching the orifice of the great Artery. MM, A portion of the heart compassing the left ventricle. Fig. 8. A the orifice of the great Artery. BCD, The Values that are set before that Orifice. EF, the beginning of the Coronall Arteries. G, Portions of the same arteries strutting forth. H, the Orifice of the Venall artery IK, his two Values. L, the filaments of the same. M, the fleshy portions to which they grow. N, the left eare of the heart inuerted. O, A portion of the arteriall Veine. PQ, the substance of the heart compassing the left Ventricle. R, the wall betwixt the ventricles of the heart called *Septum*. SS, A certaine substance at the roote of the great artery which sometimes in Beasts is bony.

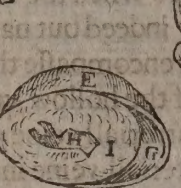
FIG. I.



FIG. II.



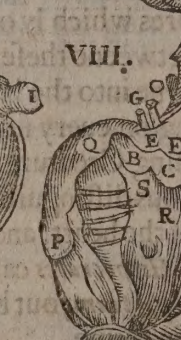
III.



V.



VII.



VIII.



heart be reboyled, attenuated and purified, both for the generation of vitall spirits, as also for the nourishment of the Lungs: for the greater part of that blood in the *Systole* or constriction of the heart is powred out into the Lungs by the Arteriall veine, but the thinner part swea-
teth through the partition into the left ventricle; for this right vètricle was created especially for the Lungs sake, as being found onely in those creatures which haue Lungs; but in those
Creatures which doe not respire but onely transpire as Fishes, this right ventricle is not
found. And so the heart maketh recompence vnto the Lungs sayeth *Galen* in the 10. Chap.
of his 6. Booke *de usu partium*, which drew in ayre for his behoofe, by making and sending
them nourishment fit for them.

Respiration &
transpiration.

The left ventricle [*tab. 10. fig. 3. HH*] is made iust in the middest of the heart; if you take
away that part which made the right you shall better perceiue it. It is narrower then the
former, because it is made to contayne a lesse quantity of matter, and his cavity is rounder,
and goeth sayth *Galen* in the first chapter of his 7. book *de Anatom. Administ.* (though *Vesalius*
be of another minde as we haue sayed) vnto the verie end of the cone. His flesh or wall is
thrice so thick [*tab. 10. fig. 8. QR*] as that of the other as well because of the smalnesse of his
cavity which must needs leaue the sides thicker, as also for that it preserueth the in-bred
heat: it is also harder and more solide to keepe in the vitall spirits that they do not exhale or
vapour out, & to poysse the body; the thicknes of this and subtilty of the contents answering
to the largenes of the other, and thicknes of his contents, that so the hart might not incline
too much on either side. In this the vitall spirits are laboured and containd together with
the arteriall blood, wherefore *Galen* in the 7. and 11. chapters of his sixt book *de usu partium*,
and *Ruffus* call it the spirituall, others the spongie, ayry and arteriall ventricle.

The left ven-
tricle.

The reason
of his thick-
nesse.

The poysse of
the heart.

For in the cavity of this ventricle the vitall spirits are laboured, and from hence by the
arteries are distributed through the whole body to cherish the in-bred heat of the parts, to
reuiue it when it growes dull or drowsie, and to restore it when it is consumed.

What is con-
tained in it.

The matter of this spirit sayth *Galen* is double, ayry and bloody mingled together. The
ayre drawn in by the mouth and the nose and prepared in the Lungs, is carried through the
venall artery into the left ventricle whilest the heart is dilated. And the blood attenuated &
concocted in the right ventricle, is partly distributed into the Lungs by the arteriall veine
for their nourishment, partly is drawne by the left ventricle through his wall and retayned
by an in-bred propriety which being mingled with the ayre is absolved and perfected by the
proper vertue of the heart, his in-bred spirit, heate and perpetuall motion, and so putteth
on the forme of a spirit, which is continually nourished by the arteriall blood. This blood
thus fraught with spirits in the contraction of the heart is powred out into the great artery
to sustayne the life of the whole body; for all life is from the heart and the vitall spirit.

The matter
of the vitall
spirit.

The inward face of both the ventricles is vnequall and rugged, that the substances which
come into the heart should not slippe out before they are perfected, for which purpose also
the valves doe stand in great stead.

The inward
superficies of
the ventricles.

That inequality commeth partly by reason of many small dennes which are more nota-
ble in the left ventricle, (wherefore *Hippocrates* in his booke *de Corde*, sayth it is more broken
and abrupt then the right, because here Nature hid the diuine fire which the Poets feyne
Prometheus stole from heauen to giue life vnto man: and *Hippoc.* because of the great heat of
this place thought it to be the seate of the soule) partly because there are certaine smal fleshy
particles [*tab. 10. fig. 5. O O fig. 6. L fig. HH fig. 8. M tab. 12. fig. 2. ss*] which about the cone of
the heart appeare small and slender, to which the neruous fibres of the valves [*tab. 10. fig. 7.
GG fig. 8. L*] called by *Galen* in the 8. Chapter of his 6. Booke *de usu partium*, and by *Ar-
changelus* the ligaments of the heart, do grow.

Whence the
inequality is?

Prometheus
fire.

These ventricles are diuided by a wall or partition [*tab. 10. Fig. 3. H, Fig. 6. HH Fig. 7. K fig.
8. R*] least the contents should bee mingled and shuffed together, which on the right side
beareth out as we sayed and is gibbous; on the left concaue and hollow, and is of the same
thicknesse with the left side of the left ventricle, as if the heart were onely made for the left
ventricles sake.

The wall of
the ventricles.

This wall is also full of holes and small trenches (it may be *Aristotle* therefore called it a
third ventricle) that in them the blood might be wrought into a further thinnesse; porous
also it is especially on the right side, that the blood might more freely passe out of the right
into the left side for the generation of vitall spirits, which *Galen* insinuateth in these words,
in the 15. Chapter of his third booke *de Naturalibus facultatibus*. Out of the right cavity that
which is thinnest is drawne by the pores of the wall, whose vtmost ends a man can scarce discern,
because

because in dead bodies all such passages fall together. That the blood is carried by these passages it appeareth because nature neuer endeououred any thing rashly or in vaine; but there are many trenches as it were and deep caues in the partition which haue narrow determinations. Thus far *Galen*.

How best discerned.
The opinion of some learned men.

These breathing passages are most conspicuous in an Oxe heart after it is long sodden. But there are some as *Varolius*, *Columbus* and *Vlmus*, who deny that there is any such passage, and will that the blood should be carried by the arteriall veine out of the right ventricle into the Lungs, part of which to remayne for their nourishment, and the remaynder to be conuayed after some alteration in the Lungs mingled with the ayre which is drawne by the breath through the venall artery into the left ventricle of the heart for the nourishment and generation of the vitall blood and spirits.

But wee will leaue this subtle question to Philosophers, for vs it shall bee sufficient to haue made this mention of both waies by which it may passe, leauing the Controuersie to farther disquisition.

The deafe-
eares:

At the Basis of the heart on either side hangeth an appendix [Table 9, Fig. 2, I K, Table 10, Fig. 3. B E] which is called the Eare, not from any profite, action or vse it hath, sayeth *Galen* in the fifteenth Chapter of his sixt Booke *de vsu partium*, and therefore wee in English call it commonly the deafe-eare, but for the similitude; for it hath a long Basis and endeth in an obtuse or blunt cone or poynt.

Their situa-
tion.
The right.

These are placed about the ventricles before the orifices or entrances of the vessels which carry matter into the heart. The right [tab. 9. Fig. 2. I, tab. 10. Fig. 1, B. fig. 3. B] which is placed neare [table 10, fig. 3. A] the hollow veine is the larger, and maketh as it were a common body together with the veine, and his cone or poynt looketh vpward. But the left [tab. 10. Fig. 2, F. fig. 3, E] placed at the arteriall veine [Table 10. fig. 3, D] is much lesse, because the orifice of this vessell is much lesse then that of the hollow veine, and beside ayre followeth more freely at a narrow passage then blood. It is also sharper and runs more on the side of the heart and is more rugged and vneuen on the outside then the right, harder also and more fleshy and thicker, for the eares haue a correspondency with the ventricles, as seeming to bee by Nature framed to bee assistant in some preparation of the matters which belong to the heart. They are hollow as making way vnto the heart.

Why the eares
haue corre-
spondency
with the ven-
tricles.

Their Figure:

Their substance is peculiar and such as is found in no other part; much like the scarfe-skinne, and membranous that they might endure the force of attraction without breaking, and also that they might better follow the motion of the heart; for they are like values stretched and contracted; when they are full and extended then are they gibbous and smooth, but when they are contracted then they appeare outwardly rugous and wrinkled, and within they resemble the vnequall superficies [tab. 10. fig. 5. the right inuerted I rugous fig. 7, the left inuerted 1. fig. 8, N] of the ventricles.

Substance.

They are thin that they might more easily be contracted, soft and neruous for strength for that is strongest which is most sinewy.

Their vse,

The vse of these eares is that whereas the blood and ayre rush violently toward the heart these should take them vp by the way, and keepe them as in a safe and let them into the heart by degrees, otherwise the creature should bee in danger of suffocation, and the heart of violence in their sudden affluence. Moreover they defend the vessels to which they are set in the motions of the heart which haue a soft and thinne coate, and therefore otherwise (when they are stretched in sudden repletion) might be subject to cracke or burst. *Hippocrates* sayed they serued the heart as fannes to coole it, or as bellows to smithes forges to gather in the spirits as they gather in wind.

CHAP. XIII.

Of the vessels of the Heart and their values.

4. vessels.

Their positi-
on.



Here are seene about the Basis of the heart in the outward sides of the ventricles foure vessels and so many orifices, whose originall some would deriue from the heart, as *Vesalius* and *Varolius*, and they are in each ventricle two. *Hippocrates* in his Booke *de Corde* calleth them the fountaines of humane Nature. In the right the hollow veine [Table 9. Fig. 2, F tab. 10. Fig. 1, C, Fig. 2. NN] and the arteriall veine. [tab. 9. fig. 2. G] In the left the venall artery [Tab. 10. fig. 2. G H] and the great artery. [Table 9.

Fig.

veine:

veine : how then is it possible that blood should bee laboured in the heart for the nourishment of the whole body when as no blood can passe out of this Ventricle into the hollow veine but onely into the Lungs? Wherefore it was necessary that Nature should provide a way out of the Lungs into the hollow vein, from whence branches might be disperfed throughout the whole body.

The arteriall
veine.
A veine by of-
fice.
An artery by
substance.
His originall.

Archangelus
his argument.

The other Vessell of the right Ventricle is the Arteriall Veine [table 9, Figure 2 G. tab. 10. figure 6. C D. table 11, Fig. 1 C] or the arteriall vessell. A veine it is, because of the office it hath to transport blood, an artery because his frame and substance is like that of an artery. It is fastned to the ventricle with a lesse orifice [tab. 10, fig. 7, C D] then the hollow veine, [table 10, figure 5, C C C] and from thence some say it hath his originall, yet it may better be imagined to be a branch and off-spring of the great arterie, because (saith Archangelus) it is most likely that a veine should come from a veine, and an artery from an artery; therefore the Venall artery, which though it have the vse of an Arterie, yet having the single coate but of a veine hath his Originall from the Hollow-veine made also of one single coate. And so the arteriall veine having the vse of a veine but the double coate of an arterie, most likely proceedeth from the great arterie which hath a double coate. Of which opinion also are Varolius and Laurentius, and it is further confirmed by their Connexion which in the Infant vnborne is more conspicuous.

The true ori-
ginall of the
arteriall veine.

The vse of the
single coate of
this arteries.

But theverie truth as I conceive is, that it ariseth as other spermatieall parts do from the seed. His coate is not simple as that of a veine, but double [tab. 11. fig. 3, B C] as an artery, and that for the vse as well of the Infant in the wombe as of the man afterward; of the Infant, that the Mothers arteriall blood and vitall spirit which it carrieth into the Lungs, dooing therein the office of an arterie, should not breathe out as it would if it were as thin as a veine: of the man afterward (and in him it dooth onely the dutie of a veine, not of an arterie) partly because in respirations it was not fit it should be easily dilated and contracted, as it would have beene if it had had the single coate of a veine; for then there would not have beene capacitie sufficient in the Chest for the instruments of breathing, and beside the blood should have had too free and full accessse to the heart; partly, because the Lungs which are of a spongy and light substance required to be nourished with a thinne and vaporous not with a thicke and crasse blood (for every thing is nourished with aliment likest vnto it selfe) which could not have beene either so prepared or contained in a vessell with a single coate, as in one with a double.

His good
vse of this sin-
gle coate.

We will add also that cause whereof Hippocrates maketh mention, that is, that the right ventricle which is not so hot as the left, might not be as much cooled as the lefte, and so at length his heate extinguished. For seeing that the branches of the Veazon which draw in the cold aer are divided between the branches of the arteriall veine and venall artery, [tab. 11. fig. 1, B C D] if the coate of the arteriall veine were but one, it would receyue as much aer as the venall artery whose coate likewise is but one, and so both ventricles should be alike refrigerated; whence it must needs follow, that the left having more heate then the right, the heat of the right must of necessity be in time extinguished, the heat of the left remaining inviolate; wherefore Nature made this vessell thicker and so narrower, to carry aer not so much for refrigeration as for refection.

His amplitude
His diuision.

This is a very notable vessell, that so much as it becommeth lesse by the thickenesse of his coates, might be recompenced in the largenessse of the Vessell, and so the Lungs have sufficient nourishment.

It leaneth vpon the great Arterie, and turning his bulke vnto the left side, is diuided into two [table 10. figure 6, C D. tab. 11. fig. 3, F F] trunks which are carried to the lefte and the right Lungs, and there distributed quite through into innumerable [table 11. Fig. 3, G G] branches.

His vse.

The vse of this vessell is in the contraction of the heart, to receyue the greater part of the blood out of the right Ventricle (in which it is made thinner and lighter that it might passe out more forcibly) and to carry it into the Lungs for their nourishment. For the heart seemeth to make retribution to the Lungs, yeelding them blood for their nourishment, because they sent aer vnto him for his refection.

But although this Veine was made thicke and hard, that it might not too easilie be either contracted or dilated, yet it is not so hard, but that his branches are contracted and dilated by the chest; and so in the next dilatation of the heart the blood must needs returne into the heart by the same way it came out; but against this inconuenience provision is made

Table 11. Figure 1.
with the Membranes
Figure 1. Sheweth the
the Arteriall Veine
Figure 4. Sheweth

A. 1. The Gallie
phagus under the
rough arterie.
B. 1. The rough ar-
C. The venall vein
D. The venall ar-
E. F. G. H. 1. The
of the Lungs.
X. 1. The Mistrice.
1. 1. The Canale or
of the Lungs.
A. 1. The Orifice of
veine.

ab. 3. His three Ve-
B. 3. The inner Co-
C. 3. The vter Co-
D. 3. The diuision of
all veine.

E. 3. The two Trunks
into it is diuided.

G. G. G. 3. The di-
the same through
of the Lungs.

A. B. C. C. 4. The
the venall Arterie.

A. where it gr-
heart, then diuide
trunks.

E. E. E. 4. Their
through the Lungs.

F. 4. The simple or
of this artery.

made by three Va-
where it twelseth

These Valves
inward do looke o-

Latine Letter C.
but one great Val-

Figure of the hal-
resemble the Mo-

Their outward
solid then the ref-

some way together
rounde Cartilage.

The Venall arte-
the left Ventricle.

because it beareth
but to it must of n-

original of pulsat-

It proceedeth
and open orifice

have his beginni-
have sprong out

vnborne.
It hath but o-

Table 11. Figure 1. sheweth the fore-side of the Lungs taken out of the Chest, from which the Heart with his Membranes are cut.

Figure 2. sheweth the backe and gibbous side of the Lungs, as it lyeth upon the backe. Fig. 3. Sheweth the Arteriall Veine.

Figure 4. Sheweth the Venall Arterie separated from the substance of the Lungs.

TABVLA XI.

AA, 1, 2. The Gullet called *oesophagus* vnder the weazon or rough arterie.

B 1, 2. The rough artery.

C 1. The arteriall veine.

D 1. The venall artery.

EFGH, 1, 2. The foure Lobes of the Lungs.

K, 1. The Midriff.

I, 2. The Canale or pipe of the Lungs.

A 3. The Orifice of the arteriall veine.

abc, 3. His three Values.

B 3. The inner Coate.

C 3. The vtter Coate.

D 3. The diuision of the arteriall veine.

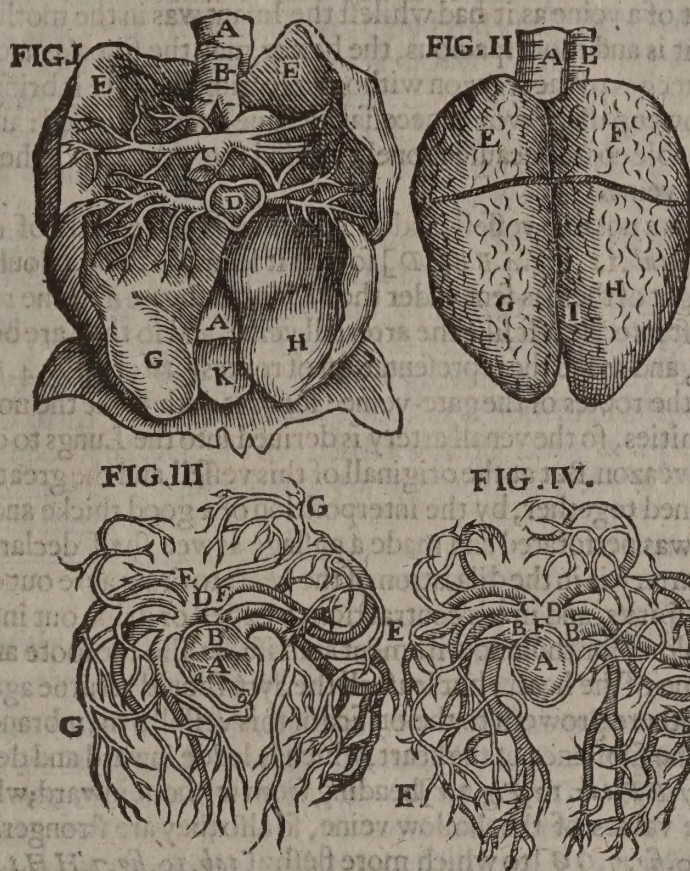
EF, 3. The two Trunkes whereinto it is diuided.

GGGG 3. The distribution of the same through the substance of the Lungs.

A, B, C 4. The orifice of the venall Arterie, marked with *A*. where it groweth to the heart, then diuided into foure trunks.

EEEE 4. Their distribution through the Lunges.

F 4. The simple or single coate of this artery.



made by three Valves [table 10 figure 6, *KEG*] which are set to the Orifice of this trunk where it swelleth a little.

These Valves haue their Originall from the very coate of the Veine, and being placed inward do looke outwarde, and each of them is like a semi-circle or halfe-moone, or the Latine Letter *C*. If all these three be together stretched and set vpright, they seeme to bee but one great Valve stopping vp the whole Orifice, and whilst they are stretched carry their Figure of the halfe-Moone; but when they sinke or flagge then they become rugous and resemble the Moone in the first quarter.

Whence the valves are. Their Figure.

Their outward Couering or Circumference, as also is that of the great Arterie, is more solide then the rest of their body; for where in both Orificies they touch themselves or ioyn some way together, they become so indurated, that they appeare to bee like a long and rounde Cartilage.

The vtter coate of this vessell.

The Venall artery [Tab. 10, fig. 2, *GH* not rightly expressed tab. 11, fig. 1, *D*] is a vessell of the left Ventricle. An artery because of his vse, for it containeth and bringeth aer, as also because it beareth as other Pulses doe; not so indeede that it can be discerned by the eye; but so it must of necessity be, because it is continued with the left ventricle where is the originall of pulsation. A veine it is as being of the substance that veines are of.

The venall arteries. It hath pulsation though not visible.

It proceedeth out of the left ventricle of the heart at his Basis with a spacious and round and open orifice [table 10, fig. 7, *CC*] greater then that of the great artery. It is supposed to haue his beginning out of the softer part of the ventricle; but it may better be beleued to haue sprung out of the hollow veine if wee marke the connexion that is found in Infants vnborne.

It hath but one thinne and simple coate in growne bodies, that the Lungs might bee his coate but nourished single.

Why this vessell
is to be capaci-
ous, many rea-
sons.

nourished with defæcated thinne and vaporous blood brought by it but sent by the heart, and that in a greater quantity then a thick stiffe vessell would carry : because the Lungs are parts of great expence as well because of their continuall motion, as also for the rarenesse and loosenesse of their substance which suffereth the thinner part of the blood to exhale from them : againe it was needfull that this vessell should be capacious, because the heat of the left ventricle required great store of ayre for the tempering of it, beside that it needed for the reparation of spirits : for in growne men it hath the vse of an artery to carry ayre, and not of a veine as it had whilest the Infant was in the mothers wombe : and againe, the larger it is and more spacious, the better may the smoake and soote passe through it into the branches of the weazon without infecting the ayre it bringeth into the heart, which in a narrower passage would necessarily haue beene mingled : and in the Infant it had no vse of a double coate because it onely carried the Aliment of the Lungs vnto them from the hollow veine.

The right
branch.
The left.

It is a notable vessell, and as soone as it is gotten out of the heart is diuided into two trunks [*tab. 11, Fig. 4. B B C D*] so that it seemeth to be a double orifice of the same vessell. The right of these is sent vnder the *Basis* of the heart into the right Lung, [*tab. 11, Fig. 1. D*] The left into the left like the arteriall veine, and so they are both disseminated through the Lungs, and make the representation of rootes [*tab. 11, Fig. 4. E E E E*] and may be compared to the rootes of the gate-veine : for as it doth sucke the nourishment with his ends or extremities, so the venall artery is deriued into the Lungs to draw ayre out of the branches of the weazon. But at the originall of this vessell and the great artery, they both meete and are ioyned together, by the interposition of a good thicke and large particle which in the Infant was perforated and made a passage as wee shall declare hereafter. The vse of this venall artery is in the dilatation of the heart to draw ayre out of the Lungs for the generation of spirits, and in his contraction to expell or drive out into the Lungs a portion of the vitall blood for their nourishment and life, as also the soote and smoake that ariseth from the flame of the heart : but least all the ayre should returne againe out of the heart into the Lungs, there groweth to the orifice of this vessell a membranous circle [*tab. 10, Fig. 7. DD*] out of the substance of the heart, which is ledde inward and deuided into two valves [*table 10. fig. 7. F F, tab. 12, Fig. 2. r*] bending from without inward; which as they excede in largenes the values of the hollow veine, so also they are stronger, hauing longer thredy strings [*tab. 10. fig. 7. G G*] to which more fleshy [*tab. 10. fig. 7. H H, tab. 12. fig. 2. ss*] explanations or risings do accrew; one of these valves looketh to the right side another to the left, which when they are ioyned do resemble a Bishops myter.

The vse of the
venall artery.

His valves.

Why but two

They are but two because this vessell was not to be ouer closely shut and that for two causes : first, seeing that all parts need vitall spirits and blood to be sent vnto them for their life, the Lungs also must neede them; wherefore as they receiued Alimentary and nourishing blood by the arteriall veine, so were they to receiue vitall by the venall artery; therefore in the venall artery there is alwayes containd subtile and arteriall blood, which that it may be, it hath onely two valves set to it, that in the contraction of the heart the way might not be altogether stopped vp, but so much space lefte as was necessary for the transuersion of vitall blood.

The necessity
of them.

But if the values were wanting then would the arteriall blood in contraction flow forth in greater quantity and with more violence, and so the great artery and consequently the whole body should be defrauded. Again, that if there should bee any smouldry excrements ingendred betweene the ayre attracted and the natue heate which is coneyned in this ventricle, they might haue free egress this way into the Lungs and so goe out by the weazon; which otherwise if they were retayned might endanger the suffocation and extinction of the creatures naturall heate.

The second vessell of the left ventricle is the great artery, of which though wee doe entreat at large in his proper place, yet it will be necessary to discourse of it here so far as shal make for our present purpose.

CHAP.

CHAP. XIII.

Of the great Artery and his values and use about the Heart.

His great Artery called *Aorta* was made before the heart; having as the heart a beginning of generation from the seed, out of which it is immediately made at the same time that the other parts are. Albeit his originall of dispensation and radicalion be from the left ventricle of the heart, from whence it issueth with an open mouth and patent orifice to receive from the same when it is contracted blood and vitall spirit laboured in it to be distributed together with the heat into the whole body. Which blood and spirits that they should not returne into the heart againe when it is dilated, there are set in his orifice [*tab. 10. fig. 8. A*] three [*table 10. fig. 8. E C D. tab. 13. character 1, 2, 3*] values like halfe Moones bending from within outward as it is in the arteriall veine, but greater and stronger because the body of the great artery is harder then that of the arteriall veine: these values are also a hinderance that the nourishment or Chylus drawn by the mesaraicke arteries out of the guttes should not be presently conveyed into the heart.

The great artery.

His valves.

The cartilage.

Or bone.

There is also placed at his orifice to establish him the better, a hard substance sometimes gristly, [*table 10. Figure 8. S S*] which in some Creatures as red Deere is a very gristle, sometimes in greater creatures it is a bony gristle for it seldome growes into a very bone, as *Galen* sayeth in the 10. Chapter of his 7. Book *de Administ. Anatom.* it doth in an Elephant: but in a man it is not so to be found. And these are the particles of the heart in a perfect Creature after it is brought into the world: now it followeth that we speake of the vessels in the heart of an Infant before the birth.

CHAP. XV.

Of the union of the vessels of the heart in the Infant vnborne which is abolished after they come into the world.



He structure and connexion of the vessels of the heart in an Infant vnborne or any other creature yet in the Dammes belly differeth much from that it appeareth to be afterward when the burthen is brought into the world. This *Galen* most perfectly and manifestly explyained in the 10. Chapter of his sixth Booke *de usu partium*. And albeit most Anatomists after him have lightly passed it over, yet will we stand somewhat more vpon it in this place although I spake of it largely in the controuersies of the Booke before going.

Galen the true obseruer of these vnions.

We sayed before that there were foure vessels of the heart, two in the right ventricle, to wit, the hollow veine [*tab. 12. fig. 1, 2, 3. a b*] and the arteriall veine [*Tab. 12. figure 1. m*] and two in the left, the great Artery [*tab. 12. fig. 12. and 3. d f*] and the venall artery: [*Tab 12. fig. 12. and 3. which in the second figure is manifest*] which vessels in the Infant are thus vnited and coupled two and two together. The hollow veine a vessell of the right ventricle, with the venall artery a vessell of the left ventricle: and the great Artery a vessell of the left ventricle with the arteriall veine a vessell of the right ventricle: which vnion of the vessels in men after they are borne is agayne disioyned.

How the vnions are made.

But these vnitions are not alwayes after one manner: for the former (partly because of the neighbourhood of the vessels, partly because of the likenesse of substances they being both veines) is accomplished by the coniunction of their mouths called *Anastomosis*, wee call it inoculation from the similitude it hath with that poynt of husbandry where a science or but a lease is so fitted to another kind as that the sap may runne equally through them both.

The former.

The latter vnion because of the distance of the vessels to be vnited is accomplished by a Canale or Pipe. The first vnion which is by *Anastomosis* or inoculation or apertion and opening of two vessels one into another, is of the hollow veine with the venall artery [*Table 12. figure 1. and 2. a g*] which is to be obserued vnder the right eare of the heart before the hollow veine open it selfe into the right ventricle [*Tab. 12. fig. 2. appeareth at b*] and neare that region where the coronall veine ariseth.

The latter.

For (touching one another so that you may easily thinke them to be but one vessell) Nature bored them with one hole common to them both [*Table 12. a g h*] which is large and patent and of an ouall figure by which the blood passeth out of the hollow veine into the venall artery and so is carried to the Lungs. But least the blood should flowe backe into the

Their common bore or hole.

The mem-
brane.

The vse of
the venall ar-
tery in the in-
fant.

In the childe
after-birth.

The admira-
ble workes of
God.

The vnion
by a pipe.

Where the
pipe begin-
neth.

Why it hath
no membrane
or couer as
the former
perforation
hath.

The vse of
these con-
iunctions.

the hollow vein there is set to the region of this bore or hole which looketh toward the venall artery, a membrane like a covering or lid [Tab. 12, fig. 2, and 3, 1.] thin, hard and transparent, larger then the hole or passage which is fastned onely at the roote; but the rest of the body of it hangeth loose in the cavity of the vessell, that falling loosely and flagging in to it selfe it might the more easily bee turned vp to the vessell of the Lungs, & the venall artery and giue way to the blood flowing forcibly out of the hollow veine, but hindering it from returning thither againe. Wherefore the venall artery in the Infant doeth the office of a veine to the Lungs, but after the birth the office of an artery; for in these whilest the heart is dilated the blood is powred out of the hollow veine into the right ventricle, and from thence when the heart is contracted thrust out by the arteriall veine into the Lungs. But in the Infant the heart being not moued and yet the Lungs requiring nourishment and encrease, Nature deuised the former way by which the blood brought vppe by the hollow veine is not powred into the ventricle of the heart, seeing neither the Lungs stood in need of attenuated blood, neither was there any generation of vitall spirits, but runneth straight into the venall artery and thence into the Lungs.

These are admirable workes of Nature, but the conglutination or ioyning together of the foresayd hole presently after, passeth all admiration; for as soone as euer the creature is borne into the world, breatheth and the heart is moued, it hath no further neede of this hole or passage, wherefore by degrees the membrane is dried vp and the bore closeth and groweth together, so that if you looke for it a few weekes after either in the heart of an Infant or of a Calfe, you would deny that euer it was perforated, but in dryer creatures it sooner groweth vp, in moyster creatures later.

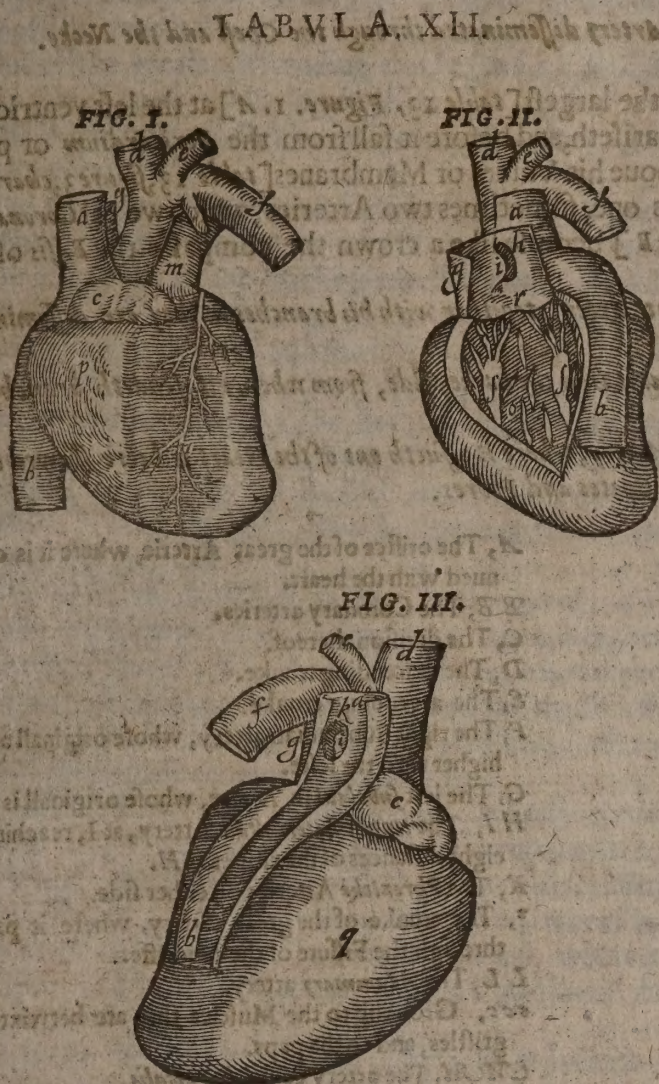
The other vnion is of the great artery with the arteriall veine [Tab. 12, fig. 1, 2, and 3, fg.] by a canale or pipe [Tab. 12, figure 1, l.] for seeing the venall artery performed the office of a veine to the Lungs, it was necessary that the arteriall veine should chaunge his vse into that of an artery: wherefore Nature also made a perforation into the great artery. But because these two vessells were a little distant one from the other [Tab. 12, fig. 1, d m] shee made another third vessell but very small, by which they might be ioyned, so that they are ioyned not by inoculation but by a pipe or canale.

This canall or pipe beginneth [Tab. 12, fig. 1, l.] not from the trunk or stocke of the great artery, but from that region of the trunk carried downward [Tab. 12, Figure 1, 2, and 3, f.] where the left nerue of the sixt payre or coniugation making the Recurrent is circumuolued or rowled about, and the pipe passeth not ouerthwart but obliquely or sidelong from the great artery [Tab. 12, fig. 1, from d to m] to the arteriall veine, where it is deuided into two trunks and appeareth as if the arteriall veine were deuided into three trunks, of which the first passed vnto the left Lung, the second vnto the right; and the third (which is a little lesse then the other two) should obliquely reach vnto the great artery, and is from the Basis of the heart in an Infant in the wombe distant about the breadth of two fingers, in a growne child after birth the breadth of foure: and the longitude of it is so notable that you may put vp your finger betweene the two vessells, but in Oxen you may easily put vp two fingers or more.

This canale or pipe or vessell call it which you please, hath no membrane ioyned to it which might hinder the regresse of the blood out of the great artery into the arteriall veine, because the length and obliquity of the pipe it selfe is sufficient for that purpose. This canale or pipe is not encreased as other parts of the creature are, but as Nature drieth vp the vmbilical or navel-veine and arteries when shee hath no further vse of them and maketh of them small tyes; after the same manner the forenamed coniunctions of the vessells which reach vnto the heart when the creature is brought forth are abolished, and this pipe is by degrees attenuated so that in a short time it is quite dried vp. But in children of three or foure yeares of age it may be found, because of the thicknesse of his roote, but not perforated or hollow.

These vnions or coniunctions are made for the behoofe of the lungs that they might be formed, growe and encrease; and therefore the pure blood of the mother is carried out of the hollow veine directly by the venal artery into the Lungs by inoculation for their generation; for they are formed at the same time with the heart, & being generated and formed they are nourished by the same matter; and encreased as long as the burthen is carried in the womb: but the vital spirit is ministred to the great artery together with the mothers arterial blood from the vmbilicall arteries, and from thence both are carried into the Lungs to pre-

Table 12. in 3. Figures, sheweth the union of the vessels of the heart, as it is found in the Infant, but abolished soone after it is brought into the world.



1, 2, 3. The ascending Trunke of the hollow-veine.

1, 2, 3. The descending trunk of the hollow-veine.

1, 2, 3. The eare of the right ventricle.

1, 2, 4. The ascending Trunke of the great artery.

1, 2, 3. The left axillary artery.

f 1, 2, 3. The descending Trunk of the great artery.

g 1, 2, 3. The Venal artery which in the second figure is open.

h 2. The Anastomosis or inoculation, as it appeareth in the venall artery.

i 2, 3. A small Membrane like a Value, closing vp the hole of the inoculation.

k 3. The inoculation as it appeareth in the Hollow-veine.

l 1. A Canale reaching into the arteriall veine, from the descending Trunke of the great artery.

m 1. The arteriall veine lifted vpward, from the right ventricle to the Lungs.

n 1. Veins and arteries disperfed thorough the coate of the hart.

o 2. The left ventricle of the

heart opened. p 1. The fore part of the heart which regardeth the Lungs. q 3. The back-part of the heart, regarding the Spondels or racke-bones. r 2. The values of the venall Arterie, with his Filaments. s 2. The fleshy implantations of the same.

preferue life through the Canale or pipe by the arteriall veine. Wherefore the vse of the coniunction is, that whilst the Naturall and vitall blood is transported vnto the Lungs, it might not fall into the ventricles of the heart; for because the heart is not moued it would remaine there, and so should the Lungs be defrauded; but when the creature is come into the world, it vscth no more of the mothers blood but his owne, where it cannot holde the same course; but it must fall into the heart, and there as afore is shewed must bee changed. But it shall not be amisse to relate the order of Anatomical administration for the finding of these vnions.

The first vnion which is by inoculation, doth elegantly appeare, if the Trunke of the Hollow-veine carried through the Chest from the Midriffe vnto the right eare of the heart bee diuided in the middest, for then wil appeare two holes or passages; the greater which is that of the inoculation into the venall artery, and the lesser which is the hole or passage of the coronary veine of the heart. But the second vnion which is by the Canale or pipe is demonstrated, if the descending trunk of the great Arterie be diuided thorough the middest euen vnto his outgate out of the left ventricle of the heart, for then withinward will appeare the small and narrow passage of the pipe into the arteriall veine.

How to find
out these vn-
ions in dissec-
tion.

CHAP. XVI.

Of the Branches of the great Artery disseminated through the Chest and the Necke.



He great Artery is the largest [table 13. Figure. 1. A] at the left ventricle of the heart whence it ariseth, and before it fall from the *Pericardium* or purse it bringeth forth about his Values or Membranes [table 13, figure 3, character 1, 2, 3.] sometimes one, sometimes two Arteries, which we call *Coronarias*, [table 13, Figure 1, B B] because like a crown the compasse the Basis of the

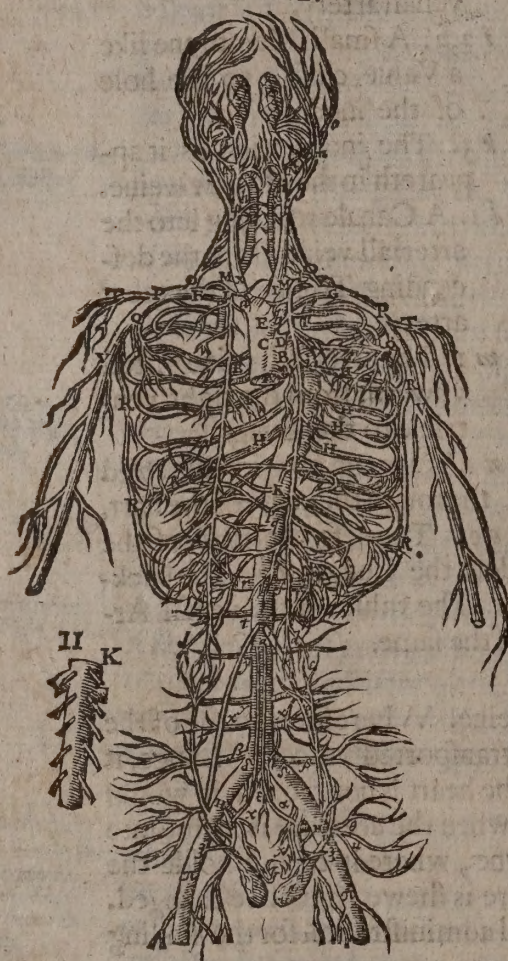
Table 13. Figure 1, sheweth the trunk of the great Artery, together with his branches as they are disseminated through the three bellies or Regions of the body.

The second Figure sheweth a portion of the Artery as it is on the backe side, from whence it sendeth branches to the distances betwixt the Lower ribbes.

The third Figure, sheweth a portion of the great Artery, where it yssueth out of the Heart is heere shewed open: and by that meanes wee may better perceyue his Coates and Fibres.

TABVLA. XIII.

FIG. I.



A, The orifice of the great Arterie, where it is continued with the heart.

B B, The Coronary arteries.

C, The division thereof.

D, The descending trunk.

E, The ascending trunk.

F, The right Subclavian artery, whose originall at a is higher then the lefte.

G, The left subclavian Arterie, whose originall is at b.

H I, The vpper Intercostal Arterie, at I, reaching to eight distances of the ribbes at H.

K, The Phrenicke Arteries on either side.

L, The trunk of the great Arterie, where it passeth through the Fissure of the Midriffe.

L L, The Mammary artery.

ccc, Growing to the Muscles that are betwixt the gristles, and to the paps.

M M, The artery called *Cervicalis*.

N N, The ingate thereof into the bone of the Occipitall.

O O, The artery called *Muscula*.

P P, The right and the left Axillary Arteries.

Q Q, The vpper chest Arterie, called *Thoracica superior*.

R R, The lower called *Thoracica inferior*.

S S, The artery called *Scapularis*.

T T, The artery called *Humeraria*.

V V, The remainder of the Axillary artery reaching to the armes.

X X, The right and left *Carotis* or the sleepey Arteries.

ee, The coniunction of the Mammary with the Epigastricke Arteries.

ff, The diuision of the sleepey arteries at the chops.

g, The externall branche.

h, The internal branche which is deriued to the throttle, the Chops, and the tongue.

i, This at the basis of the skull is distributed into two

branches. l, The distribution of the branche g, vnto the Checks, and Muscles of the face. m, The distribution of the branche g, vnder the roote of the care. n, The same branch creeping vp the temples. o, And the back side of the care. p, the stomach artery called *Gastrica*. q, The vpper Mesentericall arteries. r, s, the emlgent arteries. t, u, v, The spermatical arteries. x, The lower Mesenterical artery. y, y, y, the arteries of the Loines called *Lumbares*. a, The vmbilical arteries. b, The Arterie called *Muscula superior*. d, d, The byturbation of the great artery into the *iliack* branches. e, the artery called *Sacra*. f, f, The inner bow of the left trunk. n n, The vpper bow which descendeth to the thigh. o, The artery called *Muscula inferior*. x a, The artery called *Hypogastrica*. u, The remainder of the same bow, which being encreased by a branch from the exterior passeth by the share-bone. v, v, the artery called *Epigastrica* to which the Mammary arteries marked with ee, are ioyned. x x, the artery called *Pudenda*. x x, the Crurall artery. Fig. 2, and 3. A A A, A coate like a Spiders web. B B, the inner coate of the artery. C, the vpper coate of the artery. D E, the originall of the Coronary arteries. 1, 2, 3. Three valves set to the orifice of the Arterie in the heart,

heart : afterward yssueth out of the *Pericardium* and is vnequally diuided into two parts, one ascending vpward to the head [Tab. 13. fig. 1, E] which also is the lesse, the other and larger by farre tendeth downward [tab. 13. fig. 1, D] because the parts below the Heart, are many more then those aboue.

Out of the greater descending trunk [tab. 13. fig. 1, D] which in the Chest is large and thicke, these branches following do yssue.

The lower *Intercoastall* Arteries [tab. 13. fig. 1, H H H] which are sent vnto the distances of the eight low ribs.

The Artery called *Phrenica*, that is, of the Midriffe, on each side one [table. 13. fig. 1, K K] which are disseminated through the Midriffe and the *Pericardium*.

The remainder of the trunk pierceth through the Fissure or perforation of the midriffe [tab. 13. fig. 1, *] and cleauing to the bodies of the Spondels or rack-bones, doth diuersely communicate it selfe through the lower belly.

The lesser and ascending [tab. 13. fig. 1, F] trunk being fastned to the Weazon is communicated to all the parts of the body aboue the heart, and first of all it is forked into two notable branches, which vnder the Partell or collar-bones bendeth to the first ribs of his owne side, and therefore it is called *Arteria subclauia*, for the Latines call the collar Bones *Clauicula*, [tab. 13. fig. 1, F G] then the trunk is diuided into the two arteries called *Carotides* or the sleepe Arteries.

The right *Subclauia* [tab. 13. fig. 1, F, his originall is at a] issueth out of the great artery, euen where it is parted into the sleepe arteries, it is higher, larger, and runneth more ouerthwart then the left, whose course to the arme is rather oblique then transuerse.

From these *Subclauia* before they fall out of the Chest (for after they are not of the chest they are no more called *Subclauia* but *Axillares*) [tab. 13. Fig. 1, P P] as soone as they touch the first rib do passe certaine propagations.

From their Lower part, that which is called *Intercoastalis superior*. [tab. 13. fig. 1, I I.]

From their Vpper part yssue, first the *Mammaria* [tab. 13. fig. 1, L L] which vnder the breast bone being reflected together with the Veine, descendeth vnto the Paps and the Muscles, [tab. 13. fig. 1, C C C] betwixt the gristles of the true ribs, and so descendeth vnder the right Muscles of the Lower belly vnto the Nauell, where it is diuided into many surcles [table 13. figure 1, d d] and so meeteth with the Epigastricall Arterie ascending vpward. [table 13. fig. 1, e e.]

Secondly the *Cervicalis*, [tab. 13. fig. 1, M M] which yssueth more backward toward the bodies of the rack-bones, and at the 7. spondell of the necke entreth in at the holes of the transuerse proceses of those spondels, and so is communicated to the Muscles, the marrow of the necke, and the Spondels themselves. Betwixt the first spondell and the nowl-bone these Arteries on either side [tab. 13. fig. 1, N N] enter into the scull, and at the Basis of the braine they are vnited.

Thirdly, the *Muscula* [tab. 13. fig. 1, O O] because it watereth the Muscles of the necke.

From the Axillary artery, [tab. 13. fig. 1, P P] so called because it passeth by the Axilla or Arme-hole before it reach vnto the arme, do yssue from the lower part *Thoracica superior* [table 13. fig. 1, Q Q] which deriueth his branches to the Muscles lying vpon the breast. *Thoracica inferior* [tab. 13. Fig. 1, R R] which creepeth downe the whole side of the chest. *Scapularis* [tab. 1. Fig. 13, S] disseminated to the Muscles in the hollow part of the Shoulder-blade. From the vpper part *Humeraria* [tab. 13. Fig. 1, T T] which climbeth to the toppes of the shoulder, and is distributed into the Muscles thereabout. That which remaineth of the Axillary artery [tab. 13. Fig. 1, Q Q] being accompanied with the Axillary veine passeth vnto the arme.

That which remaineth of the ascendent trunk [table 13. Fig. 1, E] lying vpon the sharpe Artery and supported by the Sweete-bread, whilst it is yet in the cavity of the chest is diuided into two vnequall branches which they call *Carotides*, [tab. 13. Fig. 1, X X] or the sleepe Arteries, which rising directly vpward are by the mediation of a Membrane tied to the weazon and the internall iugular veines, and so attaine vnto the head. But of these we shall speake more in the eight Booke.

The descending trunk:

Intercoastalis

Phrenica

The ascending trunk:

Subclauia

The right

Intercoastalis superior
Mammaria

Cervicalis

Muscula
From the Axillary artery
Thoracica superior
Thoracica inferior
Scapularis

Humeraria

Carotides

CHAP. XVII.

Of the Lungs.



THE Lungs which are the instruments both of the voyce and also of respiration, the Grecians call *Pneumones*, because of the reception of the ayre which they call *pneuma*, or from a word which signifieth to breathe, for by breathing inward they drawe ayre, and by breathing outward doe put it forth againe. These Lungs are allowed by Nature to all breathing creatures, and placed in the cavity of the Chest [tab. 3. N O P] because they were to bee a little distant from the mouth least by the affluence of the ayre they should haue beene presently cooled. In living creatures whilest they breath inward they fill the whole cavity of the Chest, excepting the region which wee haue already sayde the membranes of the *Mediastinum* [tab. 3. L] and the heart couered with his purse doe occupy: but when the creature breatheth out then they fall, but not so as they doe in dead bodies flat and flaccid, because they are still full of ayre and bloud: and although they may bee puffed vp in a dead body by putting a payre of bellows into the weazon, yet hardly can you rayse them to such a height as that they will occupy so much place as they doe in a living body. For being to contayne so much ayre as should suffice the diuerse motions of the heart, that we might not be constrained to be alwayes fetching breath to speake, sing, or cry out, it behoueth well that their quantity should be very great.

Why placed in the chest.

How to puffed them vp in dead bodies

Why so great.

Their connexion.

How they follow the motion of the chest.

Galen's opinion for the auoyding of *vacuum* or emptinesse.

His demonstration.

How the Lungs moue when the chest is wounded.

Their figure.

Like a clouen hoofe.

How they are diuided.

And although for the most part they hang loose and at liberty that they might more freely moue, yet by the mediation of the vesselles of the weazon they are suspended and hung to the neck and the backe least they should fall downward, and by the interposition of the *Mediastinum* [tab. 3. G H to A] they are tyed forward to the breast-bone, backward to the rack-bones; also in some places at the sides of the chest they grow to the *Pleura* with fibrous tyes produced from their owne membrane, which is peculiarly obserued in man as in the wisest creature: by which meanes the Lungs which of themselves are deuoyde of all motion more easily follow the motion of the Chest otherwise then for the auoyding of *vacuum* or emptinesse.

Galen verily thought that the Lungs followed the motion of the chest for the auoiding of that *vacuum* or emptinesse which is so irreconcilable an enemy of Nature, because the chest being distended they are dilated as they are filled with ayre drawne in; and the same chest being contracted and the Lungs euacuated by expiration, they fall into themselves: which he sheweth by an instance of a wound of the chest. For if the Chest be wounded so that the ayre can get into it, the Lungs saith he become immouable and doe not follow the dilatation of the chest, because there is ayre which filleth the vacuity or emptinesse of the chest; but when the chest is sound and distended, the Lungs are necessarily dilated least there should bee *vacuum* or emptinesse, and the same Lungs, not for the auoyding of emptinesse, but either being compressed by the chest, or because of the ayre breathed out or both together, they fall necessarily.

But we adde, that Nature taking knowledge of the necessity of the motion of the Lungs, that the chest being perforated the ayre going in by the wound might not hinder the dilatation of the Lungs which is caused for the auoyding of emptinesse, hath knit them in men onely as wee said before to the *pleura*, that so by the necessity of this connexion they should follow the dilatation of the chest though it were perforated. They also adhere to the heart by the arteriall veine [tab. 9. fig. 2. G] and the venall artery.

They haue their figure (which is shewed in the 3. and 4. Tables) according to the proportion of the parts vpon which they rest: wherefore on the outside that they might bee fitted to the cavity of the chest, they are gibbous and swelling; on their inside hollow [table 9. figure 1. and 2. table 14. figure 1.] to giue way to the heart couered with his purse, which with their lobes or diuisions they encompassse round about. When both parts the right and the left are ioyned, they represent the shape of a clouen foote of an Oxe or such like, [table 14. figure 1. and 2.] for as the hooves before are diuided asunder by a line as it were; so the Lungs backward [table 13. fig. 2.] (because of the bodies of the *vertebra* or spondels) haue an oblique impression or diuision, and forward they cleaue in the very middest. They are diuided by the *Mediastinum* [table 3. G G H H] into a right Lung and a left, that one part being hurt the other might serue the vse of the Creature, (for oftentimes as wee see in the

the cutting up of the
being pleated y
And they are onely
diffeminated into
in two Lobes or
of the Chest
the lower yet so
is rather a note of
wife in Dogges
the whole Lungs
in more easily pen
finely imbrace th
they be found to b
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saith Galen in the
throat vnder the
Their substance
bowell) wouen
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riored; but the
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Their substance
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speckes or cloudy
grow yet blacker.
They haue a Mem
[Tab. 14. fig. 1. C D
and is finely stre
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Nerves do not

the cutting vp of such as dye of Consumptions of the Lungs, the one Lung on the one side being vlceraed yea and consumed, yet the man may live long with the vse of the other.) And they are onely ioyned together by the mediation of vessels [Table 14. fig. 1] which are disseminated into them from the Weazon and the heart. Againe, each Lung is diuided into two Lobes or Finnes if you draw a line from the place of the fourth rackbone or *vertebra* of the Chest obliquely ouerthwart [Tab. 14. fig. 2] to wit, the vpper Lobe or Finne & the lower, yet so, that in a man they adhere together by Membranous Fibres, so that there is rather a note or footstep of diuision then any true diuision indeede, (though it bee otherwise in Dogges) and the lower is longer then the vpper, and it is so diuided, as well that the whole Lungs might more safely and swiftly bee dilated and contracted (the aer breathed in more easily penetrating into their narrowest passages) as also that they might the more firmly imbrace the heart, and not be compressed when we bow downward. And although they be found to be distinguished (though not with any true diuision) sometimes into three, sometimes into more, sometimes into two, yet rarely shall we find in a man, because of the shortnes of his brest, five Lobes, in a Dogge and an Ape often: and if it happen to be so, then saith *Galen* in the 2. and 10 Chapters of his 7. Booke *de usu part.* They ly very high into the throat vnder the hollow-veine.

The Lobes or
Finnes of the
Lungs

Their substance [Tab. 14. fig. 2] is fleshy (whereupon it is called *Parenchyma* and a fleshy bowell) wouen with three sorts of vessels [Table 14. figure 2, B C D] and couered with a thinne Membrane, which varieth in softnesse and colour, according to the age of the party. In younger men it is faster, in the prime of our age more rare and hollow. For the Lungs being not mooued in the wombe of the Mother as neither the heart, are then thicke and firme as is the substance of the Liuer; red also from the colour of their nourishment, for nourished they are in the Mothers wombe with that wherewith they were generated, that is, blood brought out of the Hollow veine to the venall artery by inoculation, and spirits sent from the great artery to the arteriall veine by the pipe or canale before mentioned: but the infant being borne when the heart beginneth to mooue, his motion and heate softneth and puffeth vp their flesh by little and little, and so being mooued with the motion of the Chest, they also become pliable to the motions thereof, and are lifted vp and fall againe with ease; they lye also bedded as it were betweene the diuisions of the vessels filling vp the empty places, and by that meanes are a defence and strengthening vnto them that they bee not broken in their continuall motions. And this is the reason that *Plato* calleth their motion *αλμα μελινδον*, *saltus mollis* a soft motion, which is furthered in that their substance is full of a slimy and viscid moysture, insomuch that *Varolius* saith that after death if they be cut, yet will they glue together againe by this viscosity.

Their sub-
stance.

How their
substance and
colour differ
reth before &
after birth.

Plato his *Mol-*
lis saltus.
Why they
ioyne after
death, being
cut or sliced.

Their substance also is lax, spongy and rare, made as it were of the froth of the blood, that it may better admit the aer drawne in like a paire of Bellows, and be freely filled therewith. Their colour is yellowish, oftentimes ashie, spotted with certaine dull and blackish speckes or cloudye streames; and in those that dye of any long and lingering disease they grow yet blacker.

Their sub-
stance.

Their colour.

They haue a Membrane bred out of the *Pleura*, for where the vessels passe into the Lungs [Tab. 14. fig. 1 C D] there their common coate sprung from the *Pleura* departeth from them, and is finely stretched ouer the superficies or vpper face of the Lungs, to forme and containe their soft substance, which otherwise being shaken with continuall motions would quickly breake off by peece-meale.

Their Mem-
brane.

This Membrane is thinne, that it should not bee burthensome, and soft that it might better stretch with the motion of the Lungs, full also of pores though after death insensible, that if any quitture or matter should be gathered in the chest after a pleurisy or inflammation of the Lungs called *Peripneumonia*, it might by these pores haue yssue, and so be spit out by Cough; albeit wee are not ignorant that in both these diseases the Lungs themselves are affected; which wee are taught by the dissection of Pleuriticall bodies; and also by them which haue recovered of Pleurifies, in whom doth remaine difficulty of breathing, and some payne in the weakned side as long as they liue.

Why the mem-
brane is por-
ous.

This porosity also makes their vpper face smooth, & bedewed with a kind of slimy moysture. Into this Membrane, because it needed but a little sense, there are smal Nerves disseminated from the sixt coniugation, on the right side [Tab. 8. fig. 1 r] after the right Recurrent is framed, but on the left side [Tab. 8. fig. 1 q] before the framing of the recurrent, these Nerves do not reach vnto the substance of the Lungs, least they should be pained or wearied

Why Viscera
of the Lungs
are with paine

Table 14. Figure 1. sheweth the fore-side of the Lungs taken out of the Chest, from which the Heart with his Membranes are cut.

Figure 2. sheweth the backe and gibbous side of the Lungs, as it lyeth upon the backe. Fig. 3. Sheweth the Arteriall Veine.

Figure 4. Sheweth the Venall Arterie separated from the substance of the Lungs.

TABVLA XIII.

A A, 1, 2. The Gullet called *asphagus* vnder the weazon or rough arteria.

B 1, 2. The rough artery.

C 1. The arteriall veine.

D 1. The venall artery.

E F G H, 1, 2. The four Lobes of the Lungs.

K 1. The Midriffe.

I, 2. The Canale or pipe of the Lungs.

A 3. The Orifice of the arteriall veine.

abc, 3. His three Values.

B 3. The inner Coate.

C 3. The vttter Coate.

D 3. The diuision of the arteri- all veine.

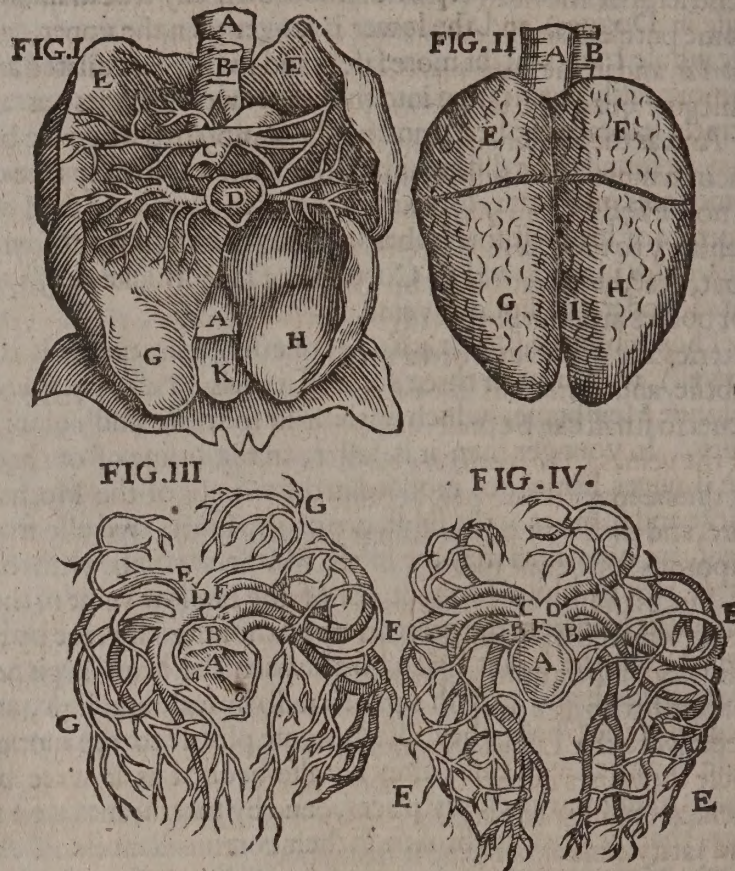
E F, 3. The two Trunkes wher- into it is diuided.

G G G 3. The distribution of the same through the substance of the Lungs.

A, B B, C C 4. The orifice of the venall Arterie, marked with A. where it groweth to the heart, then diuided into foure trunkes.

E E E E 4. Their distribution through the Lunges.

F 4. The simple or single coate of this artery.



ried in their continuall motion; and hence also it is, that all the vlcers of the Lungs are without paine.

They haue disseminated through them three vessels [Tab. 14. fig. 1. B C D] whose diuerse branches ride ouer and mingle one with another. These are diuided first into two, as the Lungs themselues are, and presently after into other parts, euery one keeping his course till at length they end in threddy branches at the very superficies of the Lungs, betweene which vessels their substance is circumfused as it is in the Liuer. One of these vessels proper vnto the Lungs is called the rough Arterie, or *Aspera Arteria*, we commonly call it the weazon or winde-pipe. [Tab. 14. fig. 1 B. and Tab. 15.] The branches of this pipe are very great, and disseminated through the middest of the others, and bringeth aer drawne by the mouth and the nose to the Lungs, of which we will speake in the next chapter.

The winde-
pipe or wea-
zon called
Aspera Arteria

The Arteriall
veine.

Two vessels it receyueth from the heart, of which wee haue spoken before, one called the arteriall veine [Tab. 14. fig. 1. c fig. 13. the whole arteriall veine] which out of the right ventricle ministreth to the Lungs Alimentarie blood therein attenuated for their nourishment, and with this blood the naturall spirit and the naturall soule therein residing with all her powers and faculties are communicated to the Lungs.

The other called the venall artery [Tab. 14. fig. 1 D. Figure 4. the venall arterie separated] which is an instrument onely of the spirits, but conteyneth also pure, thinn and vaporious blood; wherefore the aer which was attracted by the winde-pipe, and prepared in the lungs it leadeth to the heart, and from the lefte ventricle bringeth forth vitall blood with the vitall spirit and faculty to the Lungs, partly that therewith they may bee nourished, partly for their life that the in-bred heate may bee cherished, (for life is from the vitall spirite and the

the arteriall blood perfected in the left ventricle of the heart partly that by it the smoake and foot may be carried out of the heart.

These two vessels are farre greater then the magnitude of the Lungs may seeme to require if the proportion be compared to that of other parts, and that because the Lungs with their perpetuall motion do consume and dissipate much moysture; and moreover because they serve not onely to carry out naturall blood and vitall blood with vitall spirits; but also by their extremities doe receive from the ends of the winde-pipe ayre which they leade into the ventricles of the heart; and if any small braunch of these vessels be broken, the Lungs become purulent and yeeld matter vp in coughing, as Hippocrates sayeth in his first Booke de morbis, and in the same place addeth, that the Lungs with their heat do draw vnto themselves phlegme out of the whole body, especially out of the head.

And as the substance of the Lungs is differing from the substance of the whole body, so is their manner of nourishing; for there is no part either so rare, light and spirituous, or which is nourished with so pure, thinne and vaporious blood; wherefore the Lungs haue vessels contrary to those which are in other parts: for in other parts the veins haue a rare and thin coat, that the thicke blood might be freely and speedily distributed to the parts about them; for bodies are nourished with blood drawne through the veric coates of the vessels, but the arteries are thicke and dense or thight that the neighbourparts may for their life draw only subtile and spirituous blood and but a litle of it; because no particle of the body though neuer so small can be preserved without it: but in the Lungs all is farre otherwise. The coates of the veines [Tab 14. figure 3. B C] are thicke and thight, that nothing but that which is very thinne may sweate out, because euery thing is nourished with Aliment of his owne Nature, and the bodie of the Lungs being light and rare doe therefore stand in neede of a pure vaporious and thinne blood.

But because the Lungs as well in respect of their perpetuall motion, as for their store of heate which they haue partly by the vicinity or neighbourhood of the heart, partly by the assiduity of their motion; doe neede more plentifull nourishment then other parts: therefore Nature hath giuen to their arteries the coate of a veine [Table 14. figure 4. F] that they might yeeld vnto the Lungs thinne and spirituous blood plentifully and in abundance: that because the veines in regard of their thickenesse or densitie yeelded them lesse store of nourishment, abundant recompence might be made by the arteries which because of their thinne and rarity cannot containe it from them.

These three vessels some will haue to be moued according to the motion of the Lungs: others according to the heart; onely the weazon or asper arterie is dilated when the lungs are dilated. But the venall artery is moued truely after the motion of the heart, but not with the same motion nor with the same power or vertue that the arteries or pulses are moued with. For the heart in his dilatation drawes ayre from the venal artery; in his contraction he thrusteth forth a part of the vitall blood together with the footy excrements: wherefore this venall artery is emptied in the dilatation of the heart and filled in his contraction.

The vses of the Lungs is, first to bee the instruments of respiration and of the voyce, (for all those creatures that want Lungs vse not to breath and are mute beside) for being dilated, like a paire of bellowes they receive in ayre from the braunches of the windepipes, which they prepare as being the shoppe of the spirits, & by degrees change it for the vse of the heart, which otherwise should receive it impure and rushing suddenly and at once into him; and by this delay and preparation it becommeth a convenient nourishment for the in-bred spirite. For some quality of the ayre is familiar and agreeing with that in-bred spirit, another is full of enmity and will corrupt it; and hence it is that we see those that dwell in houses newly limed get diseases, and especially the fume or smother of coales and such like will presently kill a man.

This ayre the heart in his dilatation draweth vnto it selfe by the braunches of the venall artery out of the rootes of the winde pipe whose mouthes doe meete, whereby hee is cooled; for euery thing that is hot is nourished, cherished and conserued by that which is moderately cold, as Hippocrates saith in his Book de natura pueri: For as a flame being straitened in a narrow place and not ventilated with the ayre is consumed; so our Naturall heate when it wants cooling growes weaker (as they know well which sit in hot houses) and faint and is at length extinguished; for as a flame it is continually mooued; wherefore the Philosophers called the Lungs the Fan or flabell of the heart, & Plato thought that the heart when it was heated with anger was tempered againe by the Lungs.

Why these vessels are so large.

Their difference from other parts in substance & manner of nourishment.

How extraordinary in the Lungs.

How these 3 vessels are moued & by what vertues.

The vses of the Lungs.

New limed houses are dangerous to dwell in.

Againe, when they are constringed and contracted in expiration (for in inspiration and expiration life doth consist saith the Philosopher in the 21. chapter of his Booke *De respiratione*) they drive out the aer that remaineth by the same way, that it may giue place vnto that which is fresh, and make also matter for the voyce: this aer when it comes in is colde, when it goeth out hot, because it hath met with the heate that is conteyned in the Heart. Another vse of them is in expiration to auoide the fuliginous and smoaky sootinesse of the heart and spirits, and the thin and thicke excrements of the Lungs gathered in the branches of the sharpe Artery or Weazon by coughing into the Winde-pipe, which are carried vp as in a Recde and spit out of the mouth, yea sometimes cast out with a cough.

CHAP. XVIII.

Of the Weazon or winde-pipe called the sharpe Artery, or *Aspera Arteria*.

Of the wind-
pipe.

THE third proper vessell of the Lungs the Ancients called simply the Artery, because it containeth aer; the later Writers with *Galen* call it the sharpe artery, because of the inequality of his substance, and to distinguish it from the smooth Arteries; we call it commonly the weazon or winde-pipe.

His position.

It is one and a great pipe [Tab. 15. fig. 1. and 2] giuen to all creatures which haue Lungs; it looketh toward the holes of the nose which open into the mouth, and is placed before the Gullet or *oesophagus* [Tab. 14. fig. 1. A A] vpon which it lyeth in the bottome of the throate, and is carried directly downward from the mouth along the necke (which seemeth to bee framed especially for this cause) into the Lungs, into which it alwayes gapeth very wide and in his lower part is diuided into many smaller Pipes, called by *Hippocrates* in his Booke *de locis in homine*, *syringas* and *Aertras*, which determine in the Lungs with manifold branches. [Tab. 15. fig. 1. b b, c c]

The throtle
or Larynx.

The vpper part of it which is the head, is called *Larynx*, wee call it the throtle: [Tab. 15. fig. 1 and 2. g h] of it we will speake in our History of the mouth: the rest [Tab. 15. fig. 1. a a] is called *Branchius*, because it is moystened with drinke.

His connexion

The head of it or the Throtle is tyed to the throate by his inwarde coate, then by his outward coate it groweth forward, and at the sides of the Muscles and Vessels that neighbour about it, but behinde to the *oesophagus* or Gullet by certaine Fibrous tyes that it may descend downward the safer.

His substance.

The substance of this part is partly Membranous, [Tab. 15. fig. 2 f] partly gristly, [Tab. 15. fig. 2 d d] and is inuested with two coates, one outward arising from the *Pleura* which is thinne and groweth exceeding fast to the Membranous bandes of the Cartilages or Gristles, and is as it were a couering to the pipe, which by this coates interposition is tyed to the parts neere hand, and ioyneth the Recurrent sinnewes neerer to this arterie, and beside leadeth them more safely along.

His outwarde
coate.

The inwarde
coate.

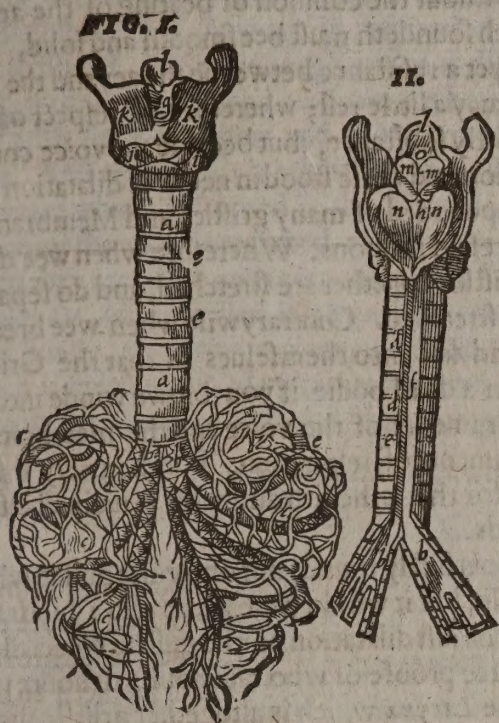
The other coate is inwarde, arising from the coate that inuesteth the Palate of the mouth: this encompasseth the whole pipe, whereby the gristles are most firmely ioyned together; it is thight and solide and much thicker then the outward, by which his thicknesse and solidity the artery is warranted from the iniuries which might come by any sharp Rheume or other matter that should fall from the head or bee hawked vp, as sometimes salt Fleame and putrid, sometimes bilious or cholericke, sometim ill qualited and sharpe quittance which is coughed out of the Lungs, or by any sharpe things that should fall or bee swallowed downe, as fumes or vapors and meats or drinckes of a tart or sharpe quality; yet is this coate in the branches dispersed into the Lungs farre thinner then in the throtle, least it should hinder the attraction of the aer, or the expulsion of the smoake or soote, but in the middle of the pipe it is of a middle consistence.

The sound of
the voyce in
burning Agues.

This coate wouen with right Fibres which runne through his length, is soft and smooth and smeared ouer with a fatty and vnctious humor that the artery might not bee dried cyther when hot aer is drawne in, or when sharpe fumes yssue out in great outcries or clamorous motions, for that such driness would bee very offense to the voyce and the transmission of aer: for when the parts which appertain to the throate and to this weazon are vehemently dried, as it happeneth in burning agues, then follow those sounds of the voyce which *Hippocrates* in many places, calleth *κλαγγή* *Changofas*, which beginne base and end sharp

Table 15. Fig. 1. sheweth the foreside of the Throttle and the weazon, and the branches of the same disseminated through the substance of the Lungs. Fig. 2. sheweth the backside of the Throttle, and of the trunk of the weazon.

TABVLA XV.



- aa 1. The pipe of the Rough Arterie of weazon.
 bb 2. The division of the same.
 ccc 1. The distribution of those branches through the Lungs.
 dd 2. The semi-circular gristles of the weazon.
 ee 1, 2. The Membranous Ligaments.
 ff 2. The membranous part of the weazon-pipe.
 gg 1. The forepart of the Throttle or Larynx.
 hh 2. The back-part of the same.
 ii 1. The two Glandules.
 kk 1. The Gristle called *Scutalis*.
 ll 1, 2. The *Epiglottis*.
 mm 2. The gristle called *Arythemoïdes*.
 nn 2. The gristle called *Crycoïdes*.
 oo 2. The slit which we call the *Glottis*.

sharp, as if the voyce failed in the end as it doth in drunken men; and this kinde of voyce is of euil presage in such Agues; but when the parts are abundantly moistned as in destillations and poases, then the sound is raucous or hoarse, but beside such destillations it is moistned by a humor contained in certaine Glandules [Tab. 15. fig. 1. ii] set at the root of the throttle or Larynx, and others that lye vpon them (for it is rare to finde small Glandules in the pipe it selfe though sometimes it be so) as also by a part of the drinke which insensiblie descendeth by the sides of the pipe [Tab. 15. fig. 1. aa] as we shall say when we come vnto the History of the Larynx.

This coate is also verie sensible, that it might quickly finde fault with that that troubles it and sollicit the Lungs to cough it vp. Betweene these two coates are placed the gristles, and their proper Membranous Ligaments. [Tab. 15. fig. 2. ee] For this winde-pipe is made of many gristles like rings, but not fully round [Tab. 15. fig. 2. dd] wanting a fourth part on the back-side, which are called *Sigmoïdes*, resembling the old Greeke *Sigma*, & our γ thus turned backward, the Physitians in *Galens* time called them *Bronchia*. These all along are equally distant one from another, & the vpper are greater then the lower, and thicker in their breadth, especially in the midst, because their midst standeth formost, that the Arterie might not easily be hurt by outward iniuries.

These by little and little are attenuated and grow thinner, and so go as it were into a membrane, and are knit to the proper membrane of every gristle [Tab. 15. fig. 1. ee] by the interposition as it were of a *Periostrion* Ligament-wise: but this ligament if it may be so called, is in brute beasts more Membranous, and in men more fleshy: or shall we call these ligaments [Tab. 15. fig. 2. ee] small muscles, because they intersect themselves like the intercostall Muscles, and fill vp the distances of the gristles.

And because the gristles do not make a perfect circle or rundle on the backpart, they are so ioynd by the help of membranous productions brought from the ends of the gristles, that the gristles with these membranes [Tab. 15. fig. 2. ff] doe make a perfect and full though not a round circle. And this their substance and structure was more meet for their vse then any other. For if either the weazon had beene made of one gristle, or of many altogether round, it would haue bin alwayes alike open, which would haue bred a difficulty in inspiration and expiration, because it is necessary that it should arise and fall with the lungs. It could not haue bin made onely of a membrane, for then the membrane being soft would fall, and so the cavity not alwaies be kept open; beside that, or any other such soft substance had bin vnmeet for the generation of the voyce, as we may perceiue in instruments when the strings are moist.

The Glandules to the Throttle.

The Gristles of the weazon

Their Forme.

Connexion & Situation.

How they are ioynd behind.

Why this their structure is best.

But

How sound is
made.

But because this pipe was to bee the instrument not onely of respiration, but also of the voyce, it behooved that his substance should be gristly and rigid, or stiffe and harde like a pipe, not onely for the freer egress and regress of the aer, but also for the necessity of the voice, because the sound could not bee made without the collision or beating of the aer as it goeth out against a hard body. For that which soundeth must bee smooth and solid, that there may bee a symmetrie or proportion, and yet a resistance betweene the aer and the substance against which the aer smiteth, at which it may a little rest; wherefore in respect of the sound it might haue consisted onely of one gristly substance, but because the voice could not be formed without inspiration and expiration and these stood in neede of dilatation and constriction, it was necessary it should bee compounded of many gristles and Membranous Ligaments, by which it might performe the foresaid motions. Wherefore when wee draw in our breath, the ligaments which tie the Gristles together are stretched, and do separate the gristles so much asunder as themselves are stretched. Contrarywise when wee breathe out, those ligaments are loosed and doubled and fall into themselves so that the Gristles touch one another, which may bee perceived in a dead bodie if you blowe winde into his weazon: and therefore the Gristles and the instruments of the voice and the membranous ligaments which ioynethem together, are instruments of respiration. For the artery it selfe prepareth the voice for the throttle or *Larynx*, for that is the first and most principall instrument of the voice, as we shall declare afterwards.

The Gristles
serue the
voyce and the
Ligaments
the breathing

The incon-
ueniency of the
rings if they
had bin round

Add to this, that if the gristly rings had been perfectly round, not onely the gullet which is soft would haue beene hurt by their hardnesse, but it would haue beene also a hindrance to the swallowing of the meate, by restraining the iust dilatation of the gullet, especially in the swallowing of solid meates, which they haue prooffe of who rauenously deuoure their meate before it bee chewed: wherefore, that the *Larynx* which is altogether gristlie, should bee no impediment to the Gullet, the Gullet in swallowing is drawne downeward, and the throttle ascendeth vppward.

The diuision
of the winde-
pipe.

When this pipe commeth [Tab. 15, fig. 1, a a] into the capacity or hollownesse of the chest to his fourth rack-bone, it is diuided into two trunks [Tab. 15, fig. 1 and 2 b b] the right going to the right side, the left to the left side of the Lungs, into which when they are passed, they are againe subdivided on eyther side into two other branches to each Lobe, and these into many others, [Tab. 15, fig. 1, c c c c] whose gristles are sometimes triangular, sometimes square, sometimes otherwise formed, and passe on disseminated euen to the extremities of the Lungs, that they may better fit themselves to their dilatation and constrictions, neither be obstructed but bee free for inspiration and expiration, and alwayes open for the auoyding of any matter Rheumaticke, Bloody or Purulent by Cough or otherwise. The branches of these diuisions are placed betweene the branches of the venall arterie and the arteriall veine [Tab. 14, fig. 1, B C D] in the midst, and are greater then either of the other, but so that the Veine is on the backside of it, and the artery on the right, which presently as it comes out of the heart entreth the Lungs, for that it was not safe that his thinne coate should runne along without some Firmament, hauing so active and flippant matter in it. Necessary it was that those branches of the Weazon should bee neere vnto both those vessels and ioyneth mouths with them; and first with the Venall artery, that so there might bee free passage out of the Rough Artery into the smooth for the aer to passe to the left ventricle of the heart, and as free an outlet for the vapours and soote, but not for blood and other humors, vlesse it bee by violent Coughing; wherefore, if at any time they become more open then they should bee, eyther by breaking one of them, or by opening of their orifices, or if any of them should be growne asunder, then part of the blood contained in the branches of the smooth Arteries is powred into these Rough, which hindreth the recourse of the breath taking vp the passages of it, and so suddenly followeth a cough, and the bloode comes vp into the mouth, but if that which insensibly slid downe the Weazon, and so passed vnto his lower pipes do thicken in the outlets which are very small, it breeds such a difficulty of breathing, as that his breath seemeth continually to faile, and hee in great necessity of perpetuall inspiration.

The causes of
coughing of
blood.

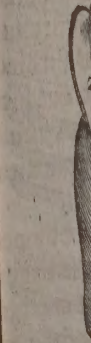
The cause of
shortnesse of
breath.

Why they
ioyneth with the
arteriall veine.

Secondly, it was necessary it should ioyneth with the arteriall veine, and that by inoculation, that from the veine it might receiue blood for his nourishment. And this is the manner of the coniunction of the Weazon to the Heart by the mediation of the smooth arteries, and how small propagations of the Veines are inserted into the strings of the winde-pipe for their nourishment, because of themselves they are altogether without blood, but the

the smooth or venous
containe blood. M
the neighbour vessel
The Vies of this
a Conduite or pipe
being dilated, other
passage constricted
mer with smoaky
note. And againe,
the voice which is
matter of the voice
when they are filled
Booke De Morbis
And finally, that
which is lightly ha
from the head, or

Hauing runne
them out of
Table 16. Sheweth
angles and what



A part of the fir
high, or the first

the smooth or venall arteries have no Veynes inserted into them, because they themselves containe blood. Moreover, the Rough arteries have small vessels deriued vnto them from the neighbour vessels.

The Vses of this Weazon are, that the Lungs as a paire of bellowes might by it, as by ^{The Vses of the Weazon, First.} a Conduite or pipe draw aer in respiration attracted by the nose and mouth (for the Lungs being dilated, onely the rough artery is dilated) and send it to the heart, and by the same passage constringed, send out from the heart the hot aer which is vnprofitable for it, together with smoaky vapors and sooty excrements, and deliuer them out of the mouth and nose. And againe, that it might bee the instrument of the voice; for to the generation of ^{Second.} the voice which is formed in the Throttle, the aer which is breathed in, and is the proper matter of the voice is required, euen as wee may obserue that in the pipes of the bellowes when they are filled with aer, there is a sound engendred. Wherefore Hippocrates is his ^{Third.} Booke *De Morbis* called it *Organum vocale and spirabile*, a breathing & vocall instrument. And finally, that with violent exsufflation either in coughing, or deepe hawking (for that which is lightly hawked vp comes but from the roots of the tongue) those things which fell from the head, or are gathered in the Lungs might by it bee cast forth.

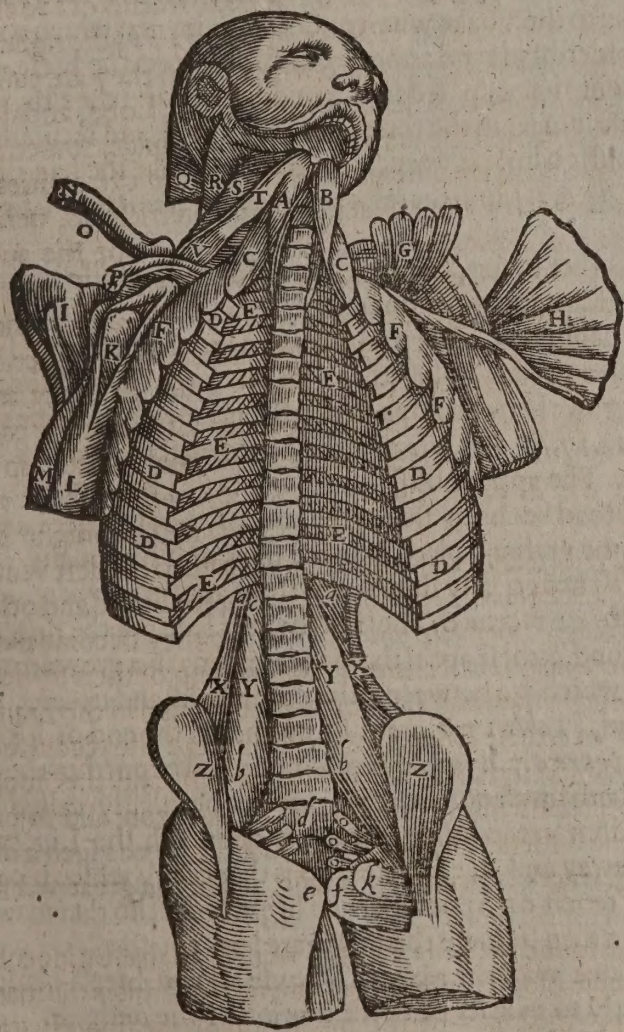
CHAP. XIX.

Of the Muscles and Nerves which are in the cavity of the Chest.

HAuing runne through all the parts containd in the Chest, and as it were remooued them out of the way, wee meete with certaine Muscles, Nerves and Bones.

Table 16. sheweth the Cavitie of both Bellies without the bowels and the Midriffe, as also what Muscles and what bones remaine when the bowelles and brest-bone are remooued.

TABVLA XVI.



- AB.* The first Muscle moouing the Necke, or the long Muscle.
CC. The second Muscle moouing the necke called *Scalenus*.
DDDD. The outward intercostall muscles.
EEEE. The inward intercostall muscles.
FF. The Muscle called *Serratus maior*, or the second Muscle of the Chest.
G. The Muscle called *Serratus minor*, or the first Muscle of the shoulder-blade freed from his Originall.
H. This Muscle called *Pectoralis* or the first Muscle of the arme separated from his originall.
I. The Muscle *Deltoides* or the second of the arme.
K. The shoulder-bone without flesh.
L. The first Muscle of the Cubite cald *Biceps*.
M. The second Muscle of the Cubite cald *Brachians*.
N. The Clauicle or collar bone bent outward.
O. The first Muscle of the Chest cald *subclauins*.
P. The higher proceffe of the Shoulderblade.
Q. The first muscle of the head or the Lower Oblique.
R. The second Muscle of the head.
S. The fourth Muscle of the Shoulder-blade or the *Leuator*.
TV. The two bellies of the fourth Muscle of the bone *Hyois*.
XXaa. The first Muscle of the backe; whose beginning is at *aa*.
YYbb,cc. The first Muscle of the thigh, called *Psoa*, whose Originall is at *cc*. And his Tendon at *bb*.
ZZ. The 7. Muscle of the Thigh.
d. The holy-bone or *os sacrum*, out of the holes whereof are at *o* certaine Nerves do yssue.

e. A part of the first Muscle of the thigh at the share-bone. *f.* The share-bone bared. *k.* The ninth Muscle of the thigh, or the first Muscle whereby it is turned.

The

- Two Muscles** The Muscles are two, called *Cervicis longi* [Tab. 16. A B] the long muscle of the neck, which being situated vnder the gullet are affixed to the rack-bones. The Muscles which are seated on the sides and behind and doe extend the head and the necke, wee haue in some sort described before in the third Chapter of this Booke.
- Two kinds of nerves.** There are also two kinde of Nerves which passe through the chest; one from the sixth paire of the marrow in the brayne, exhibited in the first figure of the 8. table: another from the spinall marrow which is either in the racke bones of the necke or of the chest; of which also we haue spoken before in the 10. Chapter.

CHAP. XX.

Of the *Claucles*, *Breast bone* and the *Ribs*.

The figure of the collar-bones.

Why not so crooked in women.

Their inequality or roughnes.

Why called *Ingula*.

Their vse.

The breast-bone.

The substance of it.

The diuision of it.

The quantity of the parts.

The gristles of this bone.

The vse of this breast-bone.

The ribs.

THE *Claucles* or *Collar-bones* are called in Greeke *κλάς* because they shut vp the whole Chest; they are two, on each side one, situated ouerthwart in the bottome of the necke and top of the breast. Their figure is not straight but outwardly embowed at the *ingulum* [Tab. 17. fig. 2. H] and on the inside hollow; contrariwise at the shoulder they are hollow on the outside & imbowed within, [Tab. 17. fig. 1, 2, 3.] but in men they are not so crooked as in Apes, and doe neare resemble the letter *J*. Likewise in women they are lesse crooked then they are in men [Tab. 17. fig. 4. R] which maketh them lesse nimble in the moouing of their armes, as wee may see when they offer to cast a stone: notwithstanding they haue a manifest protuberation or swelling, & also two lines [Tab. 17. fig. 1, 2. E, fig. 2, 3. F. G.] that from thence the *subclavian* muscle and a part of the *Pectoral* might arise. They are also on either side exasperated [Tab. 17. fig. 1, K fig. 3, P] toward their ends, from which exasperation or inequality doe proceed certaine ligaments; as also the seventh muscle of the head called *Mastoides*.

These *Claucles* on either side fasten the shoulder-blade to the breast-bone by *Diarthrosis*, a notable gristle being betweene them. [Tab. 17. fig. 5. T S] *Celsus* called them *Ingula à iungendo*, of ioyning or because they are like to the yoke wherein Oxen are ioynd which we call *Ingum*. Their vse is to hinder the shoulder-blade and armes from falling vpon the breast.

The breast-bone is called *sternum*, because it is disposed in the middest betwixt the ribs, [Tab. 17. fig. 9. g h i] or the breast-bone, because it maketh the forepart of the Chest and secureth the parts vnder it. At the end of it is a quistle a little bowed, long and broad like the handle of a Dagger as the ancients vsed [Tab. 17. fig. 6, 7.] and therefore it is dalled *ἐνδοειδής*, the sword-like cartilage or the *Breast blade*.

The substance of it is not solide as other bones, but fungous or Spongy, redde and compounded of bones and gristles. In a childe new borne it is altogether gristly, excepting the vppermost which is a bone from the beginning. Then it is deuided into eight parts; seven of them receiue the gristles of the seven perfect ribbes; the eight receiue the gristle called *ense formis*. After seven yeares they growe better compacted and haue fewer partitions and at length are onely foure. The first [Tab. 17. fig. 6. a] which is the broadest; the second and the last, the rest betweene ioyne into one. The vppermost [Tab. 17. fig. 6. a b c] is larger and thicker then the rest, & representeth the broad knubs or stay at the end of the Dagger handle. The second is like [Tab. 17. fig. 6. p q r] the grasping place, & in the sides of it hath many cauities or bosomes [Tab. 17. fig. 6. k l m n] not equally distant one from another, wherein the gristles of the third, fourth, fifth & sixth ribs are receiued. The third bone is lesse then the first [Tab. 17. fig. 6, 7. s] but broader then the second, & these are all that appeare bony in a growne man.

The gristles of it beside those two which are betweene the collar-bone and it, are, one betwixt the first bone and the second, [Table 17. figure 6. h] another in the end of it long, immouable and triangular [Table 17. figure 6, 7. E] which is commonly sharpned at the end like a poynt of a sword, whence it hath his denomination, for it is peculiarly called the *Breast-blade*. If this gristle bee in children curued downward it offendeth the Liuer and the stomacke, and such children pine away and dye. Here also is that cavity which is commonly called *Scrobiculus cordis*, the Trench or Spooone of the heart. Note also that in women the breast bone is flatter then it is in men because their paps are larger.

The vse of this breast bone is the same with the ribbes. The vse of the breast-blade is partly to defend the parts vnder it, partly to giue scope to the motion of the midriffe.

The ribs which the Greekes call *πλευράς* and *σπάθαι*, are commonly as well in men as in women on either side twelue, [Table 17. figure 9. 10. character from one to 12.] They are many

Table 17. hath two the second the poster the first Figure the The first Figure the right showeth the shape of a Heart. Figure 9. showeth one of the true ribs From the first Ch the scum uppermo

FIG. 1



Table 17, hath twelve Figures, whereof four shew the Coller-bone. The first the anterior part: the second the posterior: the third the lower part: the fourth the Coller-bone of a woman which is straighter then of a man.

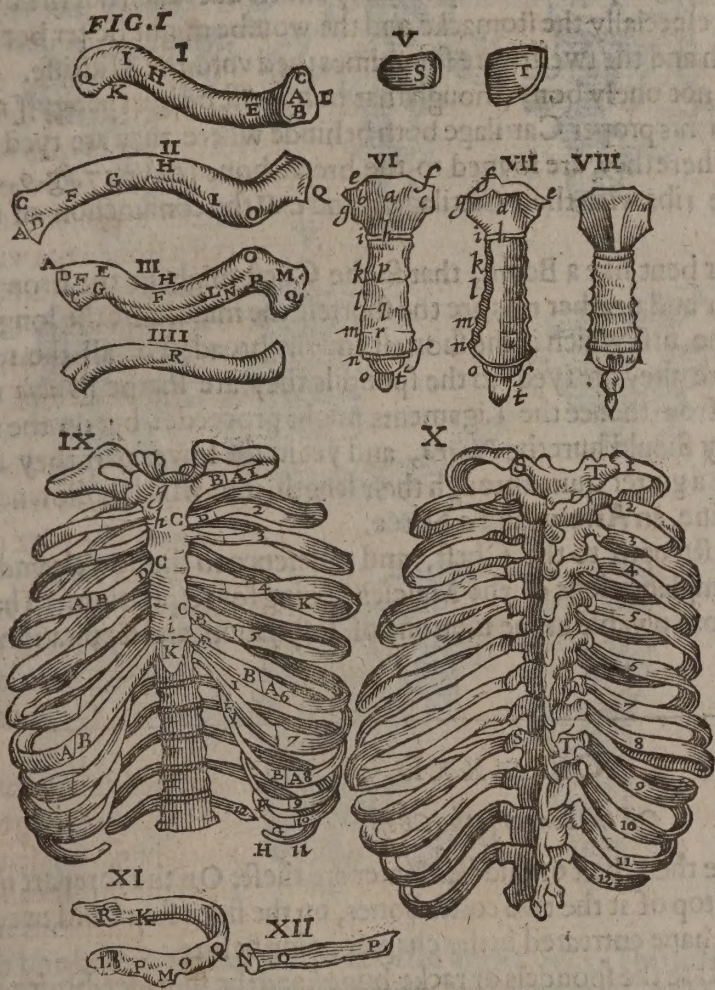
The fifth Figure sheweth two gristles placed on either side betwixt the ioynts of the Coller-bone.

The sixth Figure sheweth the fore-side of the breast-bone. The seventh the back part thereof. The eighth sheweth the fore-side of the breast-bone of a woman, together with the hole therein after the fashion of a Heart.

Figure 9 sheweth the fore-side of the bones of the Chest. The tenth the backside. The eleventh one of the true ribs broken. The twelfth sheweth the back-part of the twelfth broken.

From the first Character to the twelfth, in the 9 and 10 Figures are exhibited the twelve ribs: the seven uppermost true ribs: the five lowermost bastard ribs.

TABVLA. XVII.



A 1 2 3. The head of the clavicle which is ioynted to the breast-bone.

B 1. The first angle or corner of this head.

C D 1 2 3. The second and third angles.

E 1 3. The eminent and forward line of the clavicle.

F G 2 3. The lower line which neare G is rugged.

H 1 2 3. The middest of the clavicle or collar-bone which is round.

I 1 2. The exterior part which is broader and crooked.

K 1. A roughnesse in that place.

L M N 3. The lower side of the clavicle which is sinuated and rough, and about N there riseth a ligament which is fixed into the inner proceffe of the shoulder blade.

O 2 3. A swelling of the clavicle opposite to the breast bone.

P 3. The lower roughnesse of the inner side.

Q 1 2 3. The playne or smooth heade wherewith it is ioynted to the shoulder blade.

R 4. The collar-bone of a woman.

S 5. That cartilage or gristle of the collar-bone which is betwixt his ioynt with the shoulder blade.

T 5. The other gristle which is betwixt his ioynt with the breast-bone.

a 6. The swelling or bunching prominence of the first bone of the sternon or breast-bone. b c 6. An impression or doke on eyther hand at the sides of the sayed prominence. d 7. The backside of the breast-bone which is somewhat hollow. e f 6. The bosome or cavity which admitteth the collar-bones. g 6 7. The bosome or cavity to which the first rib is articulated. h 6 7. the articulation or ioyning of the first bone with the second. i 6 7. the sinus or hollownesse to which the second rib is ioynted. k l m n o 6 7. Other sinus or bosomes to which the five hollow ribs are articulated. p q r 6. the lines which remaine after the bones do grow into one. s 6 7. the third bone of the sternon. t 6 7. the gristle of that third bone. u 8. A hole made in the bottom of the breast bone carrying the representation of a heart.

Figure 9. 10. 11 & 12.

A B 9. The ioyning of the ribs with their gristles. C D 9. The articulation of the gristles of the ribs with the breast-bone. E 9. the blunt head of the gristle. F P 9. the gristles of the bastard ribs which are sharpe. g h i 9. the breast-bone in the middest of the ribs. G H 9. the distance betwixt the 11. ribbe where the gristle sometime is parted from the other gristles, but at 12. alwayes. I I 9. An vnequall prominence of the gristles. K 9. the sword-like cartilage. K I I. A bosome running along in the inner side of the rib. L M I I. the head wherewith the rib is articulated or ioynted to the spondel or rack-bone. L. and M sheweth the head whereby it is ioynted to the transverse proceffe. N I 2. the blunt head of the 11. and 12. ribs. O I I. 1 2. A knub into which the 11. muscle of the back is inserted. P I I. An asperity or roughnesse betwixt the two heads which bringeth forth a ligament. Q I I. A roughnesse with a light extuberation into which the muscle of the chest called *Sacrolumbus* is implanted. R I I. The fungous substance of the rib appearing when it is broken.

many

many that having many muscles, the chest might more easily be mooved, yet seldome fewer or more then 12.

Their division

They are divided into true or legitimate, and bastard or spurious ribs: the legitimate are the seven vppermost, [tab. 17. fig. 9. from char. 1 to 8] so called because they perfect their semi-circle. They are ioyned backward with strong Ligaments to the racke bones of the back [tab. 17. fig. 10. S T] by *Diarthrosis*, and that with a double knot to make them the faster.

Their Connexion. And Names.

The vpper knot is to the body of the Spondell, the lower to the laterall processe. Forward they are articulated to the breast-bone [tab. 17. fig. 9. a] by certaine gristles growing vppon their heads. The two vppermost of these are called *Retorta*, the two next *Solida*, the three last *Pectorales*. The bastard ribs are the five lower; softer as being almost gristly, at last they end into a perfect gristle. These five are retorted or bent vppward, and so are glewed together [tab. 17. fig. 9. F F] excepting the last which is the twelfth.

The substance of the Ribbes.

These are also imperfect, because they are knit only to the spondels but touch not the breast bone, that so the Lower belly especially the stomacke and the wombe might better bee dilated or enlarged. The eleuenth and the twelfth are sometimes tyed vnto the Midriffe.

The substance of the ribs is not onely bony (though that bonynesse be but spongy) [tab. 17. fig. 11. R] but euery one hath his proper Cartilage both behinde where they are tyed to the Spondels, and also before where they are ioyned to the breast-bone [table. 17. fig. 9. A B] shewes the coniunction of the ribs with their Cartilages, and C D the coniunction of the cartilages of the breast-bone.]

Their Figure Magnitude.

Their figure is semi-circular or bent like a Bowe, that so the Chest might be the stronger and more capacious. The vpper and neather ribs are the shortest, the middle are the longest and the broadest excepting the first which is the shortest and the broadest of all the rest.

Their cavity.

On the outside especially where they are tyed to the spondils they are sharpe [Table 17. figure 11. P] and vnequall, that from thence the Ligaments might proceede: but on the inside they are smooth least they should hurt the *Pleura*, and yet in the lower part they are hollowed [tab. 17. fig. 11. K] like a gutter quite through their length, into which hollownesse they receiue three Vessels, a Veine, an Artery, and a Nerue.

Their vse.

The vse of the ribs is to bee a strength to the Chest, and a defence to the bowels vnder them, they receiue also the implantations of the Muscles seruing for respiration. Their Gristles also doe make them more plyable in the motions of Inspiration and Expiration euen when we are asleepe.

CHAP. XXI.

Of the bones of the Chest.

THE bones which make the Chest or middle Venter are these. On the forepart the breast-bone, and on the top of it the two coller bones, on the sides foure and twenty ribs; of all which we haue entreated in the chapter going before.

The spondels.

On the backe-part of the chest are the spondels or racke-bones, and the shoulder-blades, of which we will speake in this place, and so put an end to our Discourse of the Middle Venter.

Their number

The Spondels therefore of the Thorax in a man are for the most part twelue [Table 20. Fig. 1, at D] iust so many as there are ribs, for euery racke hath two ribs articulated with it, [tab. 18. fig. 5, D P] wherefore also they haue two cavities, [tab. 18. fig. 1, from C to D] one at their sides, another at their transuerse processe. It is seldome seene that any of the racks are wanting, but much more rare that there should be too many.

The reason of their numbers.

The reason of their multitude is the better flexion or bending of the backe, for they are put together with ioynts knit and tyed with strong Ligaments [Tab. 18. fig. 6. character 5. Tab. 20. fig. 1, R R] betwixt euery one of which there runneth a Cartilage to make the motion nimble and glad. [Tab. 18. fig. 6. char. 1, & 3]

Their Forme or figure.

These spondels haue bodies bunching out in the middest round, embowed aboue [tab. 18. fig. 1 and below [tab. 18. fig. 1, 2, 3, 4, A] plaine, thicker also then the rackes of the necke and lesse solid, thrilled also with small holes made for the passage of those vesselles that deriue nourishment vnto them and the narrow of the backe.

Their processe.

Their processees are some sharpe, cald *Spinales* [tab. 18. fig. 1, & 2, M N P] which bend downward: others transuerse [tab. 18. fig. 1, 2, 3, 4, H I] which are thicker, solid & long ending in a round head for the firme articulation of the ribs: againe, others ascending which are two

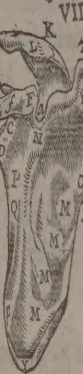
[Tab.

Table 18. The bones of the chest which are part of the eleuenth rib, Figure 7. The bones of the chest which are part of the twelfth rib, Figure 8.

FIG. I



IV



ding processees of the some which is in the uerle processe. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Table 18. sheweth the backward bones of the Chest. Figure 1. exhibiteth the fore-face of the middle Spondell unto which the other ten are very like. Figure 2. the Backe-part of the same Spondell. Figure 3. the backe-part of the eleventh Spondell. Figure 4. the backe-part of the twelfth Spondell. Figure 5. the three middle Spondells of the Chest, together with their articulation with the rib. Figure 6. sheweth the gristly Connexion of two Spondells. Figure 7. sheweth the inward part of the right shoulder-blade. Figure 8. the outward, as the 9. Figure sheweth the side.

TABVLA. XVIII.



- A, 1, 2, 3, 4, The vpper-part of the Spondell, to which the lower part is answerable.
 B, 3, The vpper Appendix of the head of the Vertebra, to which the lower Appendix is like.
 C, 1, The bosome which receiveth the rib marked with B, another lesse bosome at C.
 D, 3, 5, The bosome of the 11. racke-bone to which the 11. rib is articulated, and in the fift Figure it is sheweth together with the rib.
 E, 4, A Sinus or hollownesse in the twelfth Spondell.
 F, 4, A roughnesse or inequality in the bone bringing forth the Ligament or tye of this joint.
 G, 2, 3, 4, The holes that are in the back side of the bodies of the racke-bones.
 H, 1, 2, 3, 4, The transverse processes of the racke-bones of the Chest.
 K, 1, 5, A Sinus in the top of the transverse processes, to which the rib is articulated.
 L, 1, 2, The gibbous or embowed part of the transverse processe.
 M, 1, The hollow part of the transverse processe.
 N, O, P, 1, 2, The spine distinguished in the three sides by three lines.
 Q, 1, A sharpnesse in the inside of the spine.
 R, 3, The spine of the eleventh rack-bone.
 S, 4, The spine of the twelfth rack-bone.
 T, U, 1, The fore-face of the ascending processes.
 X, Y, 2, 3, The back-face of these processes.
 ab, 2, 3, the outward face of the descending processes.
 c, 1, Their fore-face crusted over.
 ef, 4, The ascending processes of the twelfth rack-bone which goe vnder the eleventh.
 gh, 4, The descending processes of the 12. rackbone, which are articulated to the Cavities of the ascending processes of the first rack-bone of the loynes. *ill*, 5, The three middle vertebrae ioyned together. *mn*, 5, The bosome which is in the body of the vertebra, and receiveth the head of the rib. *o*, 5, The articulation of the rib to the transverse processe. *p*, 5, The circular bowing of the ribs from D, to p, backward, from thence to s, forward. *qr*, 5, The ioyning of the rib with his Cartilage. *s*, 5, The blunt head of the Cartilage. *Char. 1, 2, fig. 6*, A Cartilage ioyning the Appendices of either rack-bone to their Bodies. *Char. 3, 4, fig. 6*, The Appendices of either rack-bone. *Char. 5, Fig. 6*, A gristly Ligament ioyning both the rack-bones.

Heere followeth a threefold delineation of the Scapula or Shoulder-blade.

A, B, 7, 8, The bosome or cavity of the blade which is called *Acetabulum*, into which the bone of the shoulder entreteth.
 a, 8, A gristle which enlargeth that cavity, which is also by it selfe described and noted in K. C, D, 7, 8, The neck of the shoulder-blade. E, 7, 8, The lesser processe of the shoulder-blade. F, 7, 8, The knub of the same, vnto which the Clavicle is connected. f, 7, The roughnesse thereof which bringeth forth a Ligament. G, H, 8, 9, The spine of the shoulder-blade.
 I, 8, 9, The thicker part of the spine which hath an Appendix. K, 7, 8, 9, *Acromion* consisting of an Appendix. L, 7, The Sinus of that *Acromion* sustaining the Coller-bone. M, M, M, M, Certaine small dens made by the contraction of the ribs. N, O, P, 7, The inward hollow part of the roote of the spine at N, O. The inward extuberation of the lower side at P. p, 7, The sharpnesse of the shoulder-blade in the vpper side. Q, 7, The Sinus of the lower side from whence ariseth the first muscle extending the Cubite. S, 8, The outward protuberation or swelling of the lower side. T, 8, An impression of the lower side from which ariseth the fourth Muscle of the arme called *Rotundus maior*. U, U, 8, The cavity of the outside of the Scapula. X, 7, 8, 9, An Appendix of the Basis of the shoulder-blade. Y, 7, 8, 9, Another Appendix of the lower angle. Z, 7, 8, 9, The vpper angle of the Basis of the shoulder-blade. q, 7, The inner protuberation or swelling of this angle. a, 7, 9, The bosome of the vpper side of the shoulder-blade. b, 9, The thinnest part of the shoulder-blade. c, 9, Heere sometime is found a small hole through which the veins do creepe for the nourishment of the bone.

M m

[table

[*tab. 18, fig. 1, TV*] and two descending [*tab. 28, fig. 2, and 3, a b*] notwithstanding the transverse proceſſe of the 11. and 12. ſpondels [*tab. 18, fig. 4, e f g h*] doe differ from the proceſſes of the reſt.

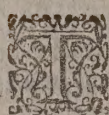
Appendices. 5. They haue alſo five *Appendices*, two at their bodies aboue and [*tab. 18, fig. 3, o*] beneath two at the tranſuerſe proceſſes, and one at the end of euery ſpine.

Their perforations. The holes or perforations of the racke-bones are bored according to the thickneſſe of the marrow that muſt iſſue out of them; [*tab. 18, fig. 2, 3, 4, G*] for as the marrow in deſcending is attenuated, ſo are the holes of the lower ſpondels ſtraightned.

CHAP. XXII.

Of the ſhoulder-blades and racks of the neck.

The ſhoulder-blade.
His connection.

 He ſhoulder-blade called *Os ſcapula* is on each ſide one [*tab. 18, fig. 7, 8, 9,*] which hangeth vpon the ribbes on the backſide like a buckler, and is articulated with the ſhoulder or arme and the collar-bone, ioined alſo to the ribs, the bone *Hyois* and the *occipitium* or nowle-bone by the mediation of the muſcles.

His Figure.

The Figure is almoſt triangular, on the inſide it is concauous or hollow [*tab. 18, fig. 7, M*] on the outſide [*tab. 18, fig. 8, VV*] it buncheth, and that bunch is called the *Baſis* of the bone; it hath alſo an angle or corner, & a rib both aboue and below, from which is produced a ſpine tending vpward. [*tab. 18, fig. 9, GH*] The vpper angle is ſhewed in the 18 *table, fig. 7, 8, 9.*

The proceſſes.

The proceſſes of this *ſcapula* aboue are three; the firſt is very ſhort and determineth with a ſhort necke [*tab. 18, fig. 7, 8, CD*] into a hollowed head [*tab. 18, fig. 7, 8, A B*] ſuch as the Anatomists call *acetabulum* wherein it receiueth the head of the ſhoulder-bone. And this hollowed head of the *ſcapula* is compaſſed with a thick griſtle [*tab. 18, fig. 8, a and K*] whereby the cauity is enlarged, leaſt that the head of the ſhoulder ſhould eaſily fall thereout.

Acetabulum.

The ſecond proceſſe is the very end of the ſpine and hangeth over the ioint of the ſhoulder; and therefore it is called *Humeri mucro* or *ſummus humerus*, The top of the ſhoulder, [*tab. 18, fig. 7, 8, 9, K*] and by this proceſſe the ſhoulder-blade is ioined to the collar-bone.

The third is inward and leſſe [*tab. 18, fig. 7, 8, E*] called *Sigmoides*, and this containeth the ſhoulder bone in his ſeate.

The appendices.

The appendices, or if you will, appurtenances of the ſhoulder-blade are five, three are in the inſide and at the *Baſis* [*tab. 18, fig. 7, 8, 9, XR*] affording a beginning to ſome muſcles; and two other out of which iſſue the ligaments which ioine the ſhoulder to that hollow head of the blade we ſpoke of, and alſo the collar-bone to the ſecond proceſſe which we called the top of the ſhoulder.

It hath alſo a double cauity, one aboue, the other beneath the ſpine with the Anatomistes *Interſcapulum*.

The ſubſtance

The bone of the blade is very vnequall, for in the middeſt it is the thinnest, the proceſſes thicke, medullous and ſpongy; it hath alſo certaine perforations by which veines and arteries are admitted for his nourishment.

The ſpondels of the neck.

The Neck which was framed to ſuſtaine the head and to mooue the ſame, conſiſteth of many ſpondels called *vertebrae* or rack-bones, which are commonly 7. [*tab. 19, fig. 2, 3, 4,*] differing one from another and from the reſt of the *vertebrae* of the ſpine.

The firſt rack bone.

The firſt [*tab. 19, fig. 2, 3, FF, tab. 20, fig. 2, 3, 4,*] is called *Atlas*, and hath a thinner yet tighter and faſter body then the reſt, and wanteth the vpper proceſſe or the ſpine. The aſcending and deſcending proceſſes of this rack are hollowed on either ſide, [*tab. 20, fig. 2, 3, EF*] aboue to receiue the two proceſſes of the *occipitium* [*tab. 19, fig. 1, DC*] for the better motion of the head, below to receiue the proceſſes of the ſecond *vertebra*: [*tab. 20, fig. 5, 6, MN*] it hath alſo at the ſides thereof two tranſuerſe proceſſes [*tab. 19, fig. 2, 3, 11, tab. 20, fig. 2, 3, 4, GG*] perforated [*tab. 19, fig. 2, K, tab. 20, fig. 2, H, ſheweth the perforation*] for the aſcent of a veine and an artery into the braine.

The cauity of it.

It hath alſo a cauity or *Sinus* [*table 20, fig. 2, 3, B*] cruſted ouer with a griſtle [*table 20, fig. 2, 3, C*] wherein it receiueth the tooth [*table 20, figure 7, O*] of the following *vertebra*, and at the proceſſes where the racks are ioined there is alſo a *Sinus* on either hand: in the firſt *vertebra* [*table 20, figure 4, Z*] and the ſecond [*table 20, figure 6, y*] it is like a chinck or rift: in the reſt it is orbicular, as alſo it is long in the racks of the cheſt. Through theſe cauities the

The uſe of the cauities.

Table 19, ſheweth
Figure 1, the
Figure 2, ſheweth
Figure 3, ſheweth
Figure 4, the
Figure 5, ſheweth
Figure 6, ſheweth



11, The proceſſes diſtally proceſſes of 4, T rack of the neck.

12, C D, The firſt vertebra to the nowle-bone at the ſecond vertebra firſt rack-bone.

The griſtle which is of

the conuexion of the ſecond vertebra

Table 19, sheweth the bones of the necke.

Figure I, the bone of the occipitum or nuchle separated from the skull.

Figure 2. sheweth the continuation of the seven vertebra of the necke as it appeareth in the back-part.

Figure 3, sheweth the fore-part.

Figure 4, the laterall face.

Figure 5, sheweth the ligaments which ioyne the first and the second rack-bones.

Figure 6, sheweth the gristles which are sometimes found betwixt these vertebrae.

TABVLA XIX.



A, 1, The hole in the nowle bone made for the outlet of the spinall marrow.

BC, 1, Two heads of the bone *occiput* or nowl-bone, which are articulated to the first rack-bone of the necke.

D, 1, The roughness wherein the ligament is inserted.

E, I, A *Sinus* or hollownes in the back-part of those heads, making a way for the first paire of sinews.

FF, 2, 3, The first rack-bone of the neck.

GH, 2, 3, 4, The cavity of the first rack-bone receiving the two heads of the nowle-bone.

II, 2, 3, The transverse proccesse of the first vertebra.

K₂, The hole of this transverse proceſſe.

L, 2, A cavity which with the cavity of the nose-
bone marked with E, maketh a common passage
which is prepared for the nerues.

M, 2, 4, A rough place there where the first rack-bone of the neck wanteth the spine.

AN, 2, 3, The second *vertebra* of the necke whose body bunching in the middest and depressed on either side, 2, in the third figure exhibiteth.

O, 2, 3, 4, The appendix or proceffe of the second
vertebra called the *Tooth*.

P, 2, A hole made of the cavity of that tooth and of the first rack-bone, through which small branches of nerves are transmitted.

2,2, A roughness wherein the hole is not perceived to be thrilled through.

R, 2, The descending proceſſe of the ſecond *vertebra*:

S.2,3, The third *vertebra* of the neck.

T, 2, The descending proceſſe of the third vertebra.

VV, 2, 4. The processes of the racke-bones on the back-side divided thorough the middest.

X, 2, 4, The backward proceſſe of the ſeventh rack-
bone which is not clouen as the former $\beta\beta$.

2, 3, 4, The highest proceſſe of the rack-bones.

Z, 3, 4, The two first extraordinary processes in the highest part of the *vertebra*.

22, 2, The extraordinary part of the laterall proecesses.

lies of the rack-bones. 44, 3, 4. The holes of the late-

character 1, 2, 3, 4, 5, 6, 7, Shew the seven vertebra or

lower end of the body of the third rack at the two

two following pieces: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 84

Figure V.

ABCD, The first *vertebra* of the necke. *ABC*, The second *DD. EF*, A membranous ligament knitting the first *vertebra* to the nowle-bone at *E*, and the first to the second at *F*. *G*, The body of the second *vertebra*. *H*, The *Tooth* of the second *vertebra*. *I*, The ligament tying the *Tooth* to the nowle-bone. *K*, A ligament compassing the *Tooth* of the first racke-bone.

Figure VI.

The griffles which *Vesalius* saith are sometimes found betwixt the two first vertebrae.

the coniugation of the nerues and the branches of the veines and arteries do passe, which minister nourishment vnto the marrow and to the bones.

The second vertebra [*tab. 19, fig. 2, 3, N, tab. 20, fig. 5, 6, 7,*] besides his body, his laterall
Mm 2 process

Mm 2

process

Table 20. Figure 1. sheweth all the rack-bones of the backe knit together. Figure 2. sheweth the fore and upper face of the first rack-bone of the necke. Figure 3. sheweth the backward and upper face of the same. Figure 4. the lower and backward face thereof. Figure 5. the forepart of the second rack-bone. Figure 6. the back-part of the same. Figure 7. the lower part of the said second rack-bone. Figure 8. the foreward and upper face of the third vertebra. Figure 9. the backer and upper face thereof.

TABVLA. XX.

FIG. I



From, A, to B, The seven vertebrae of the necke.
 From C, to D, The twelve vertebrae of the chest.
 From E, to F, The five rack-bones of the Loynes.
 From G, to H, The Os sacrum or Holy-bone.
 From I, to K, The bone Coccyx or the rump-bone according to the late writers.
 LL, The bodies of the vertebra.
 M, The transverse processes of the vertebra.
 N, The descendent processes.
 OO, The ascendent processes.
 PP, The backward processes.
 QQ, The holes that are in the sides of the vertebra through which the nerves are transmitted.
 RR, A gristly ligament betwixt the vertebra.
 A, 2, 3, 4, The hole whereout the marrow of the backe issueth.
 B, 2, 3, The cavity which admitteth the root of the second rack-bone.
 C, 3, 4, A cavity or Sinus in the same place crusted over with a gristle.
 D, 2, A prominence in the outward region of this Sinus.
 EF, 2, 3, The Sinus or cavity of the first rack-bone which admitteth the 2. heads of the nowle-bone.
 GG, 2, 3, 4, the transverse processe of the 1. vertebra.
 H, 1, The hole of this transverse processe.
 I, 3, The Sinus, which together with the cavity of the nowle-bone marked with E, maketh a common passage prepared for the nerves.
 K, 3, 4, A rough place where the spine of the first rack is wanting.
 LL, 4, Two cavities of the first rack receiuing the 2. bunches of the second rack marketh with MN.
 MN, 5, 6, The 2. bunches of the second rack which fall into the cavities of the first.

O, 7, The appendix or tooth of the second rack. P, 3, A knub of this appendix crusted over with a gristle. Q, 6, The backside of the tooth. R, 6, the Sinus or cavity of the same, about which a transverse ligament is rowled containing the said tooth in the cavity of the first rack. ST, 6, Certaine cavities at the sides of the tooth whence the roots issue of the fore-branch of the second paire of sinews. V, 5, the point of the tooth. X, 3, An asperity or roughnes where there is a hole but not thrilled through. Y, 6, A cavity of the second rack which together with the cavity marked with Z, maketh a hole, through which the nerves do issue. Z, 4, the Sinus of the first rack. a, 5, 6, 7, the double spine of the second rack. b, 5, 6, 7, the transverse processe of the second rack. c, 7, the hole of the said transverse processe. d, 6, 7, the descending processe of the second rack whose cavity is marked with d, in the 6. figure. e, 6, 7, the place where the body of the second rack descendeth downward. f, gg, 8, the lower side of the body of the third rack at f, the two eminent parts of the same at gg. h, 8, the ascending processes. Im, 8, the two descending processes. n, o, p, q, 8, the transverse processes. r, 8, 9, the spine or the backward processe. st, 8, the two toppes of the spine. u, 9, the descending processe of the third rack. x, 9, the ascending processe. y, the transverse processe of the third rack. z, 8, 9, the hole of this transverse processe. A, 9, the vpper hollowed part of the body of the third rack. B, 9, the Sinus or cavity which maketh the lower part of a hole through which the conigations of the nerves are led. a, 7, the vpper part of the same hole.

processes [tab. 20. fig. 5, 6, 7, b] which are short and obliquely perforated [tab. 2. fig. 7, c] his backward processe byfurcated [tab. 20. fig. 5, 6, 7, a] because of the muscles, and beside his ascending processes lightly bunching out, and his descending [tab. 19. fig. 5, R, tab. 20. fig. 6, 7, d] lightly hollowed; beside all these (I say) there ariseth out of the middle of his body an appendix commonly called a processe which is round and long [tab. 19. fig. 2, 3, 4, O, tab. 20. fig. 6, Q, figure

fig. 7, O] and is called *ὀδοντοειδής* because it is like that tooth of a man which we call the Dog tooth. The surface of this tooth is somewhat rough to giue an originall to a ligament [tab. 19, fig. 5, E] whereby it is tyed to the occipitium: it is also compassed with a round and solide ligament [tab. 19, fig. 5, K] lest the marrow should bee compressed: it is also ioyned with the first by a broad ligament [tab. 20, fig. 5, F] compassing it about.

The third spondell of the necke [tab. 19, fig. 2, 3, SS, tab. 20, fig. 8, 9,] which is called *ἄνω* The 3. spondell (and groweth together very firmly on the fore side with the other foure) as also the 3. following haue their laterall processe bifurcated or forked [tab. 19, fig. 2, VV, fig. 4, 6] because of the implantation of the muscles. But the seventh spondell [tab. 19, fig. 2, 3, 4, character 7,] Seventh. is like the rack-bones of the chest, and his backward processe is not alwayes forked [tab. 19, fig. 2, 4, X] but sometimes whole, the body below is plaine that it may fully ioine with the following vertebra.

All of them (except the first) haue appendices betweene which doe run thicke and soft gristles to make them more nimble and free. Their appendices.

And thus much shall suffice for the bones of the chest in this place; where also we will put an end to the History of the middle belly, and proceede to the Controuersies concerning the same.



A Dilucidation or Exposition of the Controuersies concerning the Chest and Heart, &c.

QUEST. I.

An Anatomical demonstration concerning the Phrensie of the Midriffe.



THe ancient Physicians before *Plato*, did not call the Midriffe *Diaphragma*, but *φρέν*, not because there was in it any seate of wisdom which the Greeke word signifieth, but because when this muscle is inflamed, presently followeth the disease called *Phrenitis* or the Phrensie, which is a continuall abalienation or distemper of the minde, ioyned with an acute feuer and want of rest or sleep. The inflammations of many parts breede this deliration, as of the Liuer, the Stomack and the Lungs; but such distemper is but vncertaine and at sometimes not continuall, onely the inflammation of the midriffe breedeth a perpetuall or continuall phrensie, which so neerely resembleth the true phrensie arising from the inflammation of the brain and his membranes, that it may deceiue a Physicion vnlesse he be right skillfull: we will deliuer in this place the signes how they may bee distinguished. They are therefore discerned the one from the other by respiration, by the voyce, and by the handling of the *Hypochondria*. The true and primary phrensie which commeth from the inflammation of the braine or his membranes, maketh the respiration great, and that is deepe and long, seldome and rare with much distance betweene the breathings: but in the phrensie of the midriffe the respiration is frequent or quicke, small or shallow, because the instrument of respiration is inflamed, so that the chest cannot moue or be enlarged in all his demensions in inspiration, nor yet bee freely collected or gathered vp together in expiration, as it may bee in the former,

Why the midriffe is called *phrenes*.

What is a phrensie.

How the phrensie of the midriffe is distinguished from that of the Liuer, and other parts.

How from the phrensie of the braine.

How by the respiration.

Mm 3

where

where the instrument of breathing is not tainted or violated, but only the braine: So it becoms frequent & quick, often returning, because of the necessity imposed by the flame of the ague for so the shallow breathing is recompenced by often breathing.

How by the
voyce.

Secondly, these phrensies are distinguished by the voyce: for in the phrensie of the braine the voice is base; they cry out, spurne and bite any that comes neere them: contrariwise in the phrensie of the midriffe the voyce is acute or treble, because the chiefe instrument of free respiration is affected, and being drawne vpward by the inflammation, the chest becometh narrower; for the magnitude and basenes of the voyce follows the constitution of this instrument.

How by the
retraction of
the Hypochondria.

The last and most proper signe of this phrensie of the midriffe, Hippocrates deliuereth in the 5. Aphorisme *Concarum praeotionum*, where he saith: In these men their *Hypochondria* appeare *intro sursum reuulsa*. i. to be drawne inward and vpward: the demonstration of which saying is to be made by Anatomy thus: The midriffe in the vpper side is covered with the *pleura*; on the lower with the *Peritoneum* or rim of the belly, which incloseth as in a sacke all the natural instruments and parts contained in the lower belly, and giueth euery one of them his owne coate. The midriffe then being inflamed, is drawn vpward, and raiseth with it the *Peritoneum*: with the *Peritoneum* are the *Hypochondria*, the Liuer, the Spleene, the Stomacke, and all the bowels retracted; and so comes that inward and vpward reuulsion of the *Hypochondria* Hippocrates mentioneth: wherefore these are the three proper and demonstratiue signes of the phrensie from the midriffe: small or shallow and frequent respiration, a shrill or treble voice, and the vpward and inward reuulsion of the *Hypochondria*. But why happeneth it, that when the midriffe is inflamed, there followeth a phrensie? Some thinke that when the midriffe is inflamed, the braine is also presently alike affected; for the inflammation of the midriffe hindering respiration, the heat is increased in the chest and the heart, the blood is attenuated and groweth cholerick and flyeth vp into the braine, whence commeth an *Erysipelas*, that is a cholerick inflammation of the braine, the immediate cause of the true phrensie; but these things are ridiculous. For if it were so, then whensoever the Lungs also are inflamed, presently a perpetuall phrensie would follow, because there followeth both a difficulty of breathing, and the Lungs are nourished with a bilious, that is, a very thin blood: moreover, if an *Erysipelas* should breede in the braine, then were the phrensie a true phrensie, and not depending vpon the inflammation of the midriffe. Others referre the cause of the phrensie to an analogie or proportion in all correspondency betwene the midriffe and the brayne. But because the marrow of the back is more correspondent to the brayne, and yet when that is inflamed, there followeth not alwayes a perpetuall phrensie, wee doe worthily search farther for the cause.

The Anatomical
demonstration.

The three demonstratiue
signes of the
phrensie from
the midriffe.
Why when
the midriffe is
inflamed,
there followeth
a phrensie.

The true cause

We therefore vnderstand that there is a double concurring in this busines, to wit, a wonderfull connexion and society of these two parts, and then the perpetuall motion of the midriffe. The society is by nerues, which communicate both heate and a vaporious spirit to the braine. And the continuall and strong motion of the midriffe drieth vp with force and violence smoaky vapours to the braine. For if you only admitt the society or sympathy of the nerues, why should not the same phrensie fall out when the mouth of the stomacke is inflamed, which hath notable stomachicall sinews which from the braine are inserted into it?

QUEST. II.

Of the motion of the Heart and the Arteries or Pulse, a Philosophicall discourse.

Euery man
carries a perpetuall
motion about him.

He busie wit of man obseruing the perpetuall motions of the heauens, hath long trauelled to imitate the same, and in making experiments, hath framed excellent and admirable peeces of workmanship, whilest euery one carried a perpetuall motion about himselfe, which happily he little remembered or thought vpon, and that is the perpetuall motion of the heart, which from the day of birth, till the day of death, neuer ceaseth, but moueth continually: by what engines and pullies, what poyles and counter-poyles, what affluencies and refluencies this perpetuity is accomplished, we imagine wil neither be vnprofitable nor vnpleasant to vnderstand, especially to those that desire to know and acknowledge the admirable works of God in this little world of the body of man, as well as his great administrations in the greater. We reade of *Aristotle*, that when he was in banishment in *Chalcide*, and obserued the seuen-fold Ebbing and Flowing in one day and a night of the *Euripus* or narrow Frith betwene

The cause of
Arteries, death.

twene *Aulis* and the Iland *Eubaa*, and could not finde out the cause of it, he pyned away euery to death with sorrow. Me thinks therefore that euery man when he put his hand but into his bosome and feeleth there a continuall pulsation, by which he knoweth his owne life is gouerned, should also be desirous to vnderstand what maner of engine this is, which being so small that he may couer it with his hand, hath yet such diuersities of mouing causes therein, especially considering that a little skill to cleere and dresse the wheelles may keepe this watch of his life in motion, which otherwise will furre vp & finally stand in his dissolution. We will therefore a litle payne our selues, to discourse of the manifold difficulties wherein the causes of this motion are so intangled, that some not meere vnclearned haue thought, that they are onely knowne to God and Nature and to none other.

The heart compared to a small watch.

The motion therefore of the heart is double; one naturall, the other depraued. The naturall we call the Pulse, the other we call Palpitation: the one proceedeth from a naturall faculty, the other from an vnaturall distemper: the one is an action of the heart, the other a passion. Our discourse shall be only of the naturall motion which consisteth of a dilatation called *Diastole*, a contraction called *Systole*, and a double rest betweene them.

The motion of the heart double. The Naturall motion.

Aristotle imagined the only cause of this motion to be heate, but perpetuated by the continuall affluence of oylie moisture, which as continually is consumed as it is ministred, euery as oyle put to a lampe: but the dilatation (saith he) commeth from ebullition or boyling of the blood, whereby it riseth and occupieth a larger place, yea and powreth it selfe out into all the caviety adioyning thereto: and this he illustrateth by an example taken from boyling water; water when it boileth riseth vp and occupieth a larger place then it did before, but if you blow cold ayre into it, it presently falleth; right so is it (saith he) in the heart of a man, the heate boyleth vp the blood, and the cold ayre we draw in by inspiration setteth it againe: and this is farther proued because the pulses of yong men are more lively and stronger then of old, of whole men then of sicke, of waking men then of sleeping, because their heate is more vehement, and the feruor or working of their blood more manifest. These things are very probable, and carry (I must needs say) a great shew of trueth, but if they be weighed in the ballance of Anatomy they will bee found but light. Herein was the Philosophers error that hee vnderstandeth the heart to be distended or dilated, because it is filled: contrariwise, the Anatomist vnderstandeth the heart to be filled because it is dilated.

Aristotles conceit of the cause.

A pregnant example.

Another instance.

Wherein was the Philosophers error.

In the depraued motion or palpitation of the heart it is distended indeed, because it is filled either with water or with vapours, but in the proper and naturall it is dilated by an inbred power of his owne, and being dilated drawes in blood and spirits, and so is filled, like as a Smiths bellows being opened by the power of the Smith is filled with ayre whether hee will or no; bladders whilest they are filled are distended, those fill in the dilatation, these dilate in the filling.

Comparison

Beside this conceit of *Aristotles*, others haue diuersly deuised conceits concerning this motion. *Erasistratus*, *Hiracleus*, *Erithreus*, conceived that the motion of the heart was from the Animall and vitall faculties together. *Auerrhoes*, that it was from the appetent and sentient Soule; and that the heat was but the Instrument which the appetite vsed: others thought that nature only moued the heart, because alone it is said to bee *principium motus*, or beginning of motion in those things that are moued: others, that the dilatation of the heart was from the Soule, and the contraction meere naturall, the sides of the heart falling down with their owne waight, like as in the disease called *Tremor*, or the shaking palsie; the faculty of the Soule continually rayseth vp the head, and the waight beareth it downe againe, whence the perpetuall shaking proceedeth.

Erasistratus, *Hiracleus*.

Auerrhoes.

Other opinion.

The cause of the shaking palsie.

But trueth is, the motion of the heart is no trembling but a constant and orderly motion; neither is the contraction caused by the waight of the heart, it buckling vnder the burthen of it selfe, but the greatest strength of the heart is in the contraction, whereby it hurleth forth (as the lightning passeth through the whole Heauen) his spirits into the whole body, and excludeth oftentimes not without violence, the fumed vapours into the Arteriall Veine. But before wee set downe our resolution concerning this matter, a few things are to bee first established.

The kinds of motions.

Voluntary motions.

There is a threefold motion; Violent, Animall, and Naturall: of violent motions none at all can bee perpetuall, whereupon wee may conclude that no Art can make a perpetuall motion. Animall motions are all voluntary: this *Galen* well describeth in the fifth Chapter of his second Booke *De motu musculorum*, where he sayth, If thou canst settle and appease those things that are moued or done at thy pleasure, and againe moue or doe that was at rest

rest or was not done, that action or motion is truly voluntary; if moreover thou canst doe any thing swifter or slower, oftner or seldomer at thy pleasure, these actions are obedient to thy will.

Natural motions manifold.

Finally, the Naturall motion is manifold, as a thing may diuers waies be said to be naturall. There is one simple naturall motion which is accomplished onely by Nature and the Elementary forme; with this motion heavy things moue downward, and light things vpward. Secondly, all motions are called Naturall which are opposed to violent motions; so the motions of the muscles, though they be voluntary, are said to be naturall, if they be naturally disposed. Thirdly, all motions are called Naturall which are not Animall, that is, voluntary: So *Galen* saith in the place before quoted, that the motion of the heart is not of the Soule, that is, of the will, but of Nature: and againe, the motion of the heart is of Nature, the motion of the chest, of the Soule.

The resolution of the question

So that *Galen* in his 7. Booke *de usu partium*, deliuering but two kinds of faculties, the one Animall, the other Naturall, vnderstandeth all that to be Naturall which is not Animall or voluntary. Now we conclude, that the motion of the heart is Naturall in the third acception; that is, that it dependeth neither vpon the will, nor simply vpon Nature; but vpon the vitall faculty of the Soule which is Naturall: not vpon the will, because wee can neither stay it nor set it going againe, neither slacken nor hasten it at our pleasure: not simply vpon Nature, for in a body that is animated, that is, that hath a Soule, nothing moueth but the Soule, otherwise there should bee more formes then one, and more beginners of motion then one, which true and solide Philosophy will not suffer. This Soule is the Nature it selfe of the Creature, which that it may preserve the vnion betweene the body and it selfe, moueth the heart, concocteth in the Stomacke, reboyleth in the Liuer, and perfecteth the blood in the Veines. When wee say therefore that the motion of the heart is Naturall, we meane that it is from a Naturall faculty of the Soule which is not voluntary. And that this motion is Naturall, all the causes of it do evidently shew.

Three immediate causes of the pulse.

There bee three immediate causes of the pulse, the Efficient, the End or finall cause, and the Instrument, all Naturall.

The Efficient.

The Efficient cause is the vitall faculty, which imploiethe it selfe wholly about the generation of spirits, which by that perpetual motion are brought forth, for in the *Diastole* or dilatation it draweth blood & ayre. In the *Systole* or contraction it driueth out the spirits already made, and their excrements.

The Finall.

The Finall cause (which you may call either the vse or the necessity at your pleasure,) is three-fold; the nourishment of the spirituous substance, which is kept in the left ventricle of the heart; the tempering and moderating of it (for there was great danger, that because of the continuall motion the heart should be inflamed, vnlesse it had bene ventilated with ayre as with a fan) and the expurgation of smoky or fumed vapors.

The Instrument.

The Instruments also of this motion are Naturall, not Animall. *Galen* calleth the Animall Instruments, the Muscles and the Nerves: the heart is no muscle, vnlesse we speake abusively, because of the fastnes and colour of his flesh; and for nerves there are none that reach vnto his ventricles. There is indeed a small surcle or tendrill from the sixth coniugation that maketh the Recurrent, which is disseminated in the purse and Basis of the Heart, but the Heart standeth in no need of it for his motion; for if this nerue be intercepted with a string, or (which is the surest way) his originall, which is easily perceived by the sides of the weazon; yet neuertheless is the heart moued as also the arteries, as in *Dogges* wee haue often made experiment. Seeing therefore all the causes of the hearts motion be Naturall, we may conclude that it selfe is Naturall, coming from the vitall faculty which is not voluntary.

The first obiection.

But that the truth of this conclusion may more plainly appeare, some obiections must be answered, which otherwise would breede scruple in the mindes of them that are not sufficiently grounded in these secrets of Nature.

Answered.

First therefore say some, all naturall motions are continuall; but the motion of the heart is interrupted with a double rest, one betweene each motion. Let vs admit that one simple Naturall motion is continuall: yet when there are two naturall motions and those contrary, there must needs be a rest betweene them.

The second. Answered.

Secondly, they say, no naturall motion is compound: but the motion of the heart is compound. I answer, The motion of the heart is not compound, but double not simple; because of two contrary motions cannot be made one compound motion; neither of many motions is made one motion as one line of many points.

Thirdly,

Thirdly, they vrge vs further thus, with *Aristotle* in the 7. Booke of his *Metaph.* Whatsoever is moued by Nature is moued to some end, which end when it hath obtained, then it resteth; as water being heated, if by it owne force and proper forme it be cooled, it neuer groweth hot againe by the same forme or force. Wherefore if the heart be moued naturally, it is moued that it may be dilated or contracted; when therefore it is dilated, why is it contracted? and when it is contracted, why is it dilated againe? I answered, that that is true in a motion that is purely and meere natural; but the motion of the heart is from the vitall faculty of the Soule, which hath a naturall instinct and knowledge of his own vse, and according to the diuers appetites of that naturall instinct moueth diuersly. For when the heart is contracted, it desireth to be dilated that it may draw in cold ayre, when it is dilated or distended, it desireth to be contracted to auoide the smoke and soote that by his heate are ingendred: so the vitall facultie of the Soule which is sensible of his owne want, moueth the heart perpetually with diuers motions, according as the needs of the Soule do require. By which this motion of the heart is distinguished from other motions of the naturall faculty of the Soule, to wit, of the wombe and the stomacke. For the motion of these parts is not perpetuall, because there wanteth a perpetuall object, neither doth any necessity vrge, the finall cause it is not alwaies at hand, but the heart hath a continuall object, necessity and end: for it wanteth perpetuall nourishment, tempering and expurgation. Finally, they contend that the motion of the hart is not naturall, because it is to two contrary points, but opposite and contrary motions are onely performed by the Animall faculty: so the arme is lifted vp and pulled down onely by the will. I answered, that in things without life this is true, but all things that haue life, yea even in plants themselves there is motion to contrary points. I say more, there is neuer in the Soule one motion, but presently resulteth another opposite or contrary vnto it: so in nutrition, the attraction of the Aliment is from the Soule, so is also the expulsion of excrements from the same Soule. The Soule is so diuine a thing, that not onely it doth many things beside the laws of other formes, but also is the author of contraries; for it moueth vpward and downward and beyond the Nature of Elements, to the right hand, to the left, and circularly. The motion of the earth is simple and vniforme, the motion of the Soule manifold, because the forme of the earth is one and simply simple. The Soule is simple, manifold, and manifold waies: Simple in his Essence, manifold in his Power and Vertue, and manifold waies in his knowledge of objects, from which his operations and actions are drawne.

We therefore conclude that the motion of the heart is Naturall, and proceedeth from the vitall faculty for a certaine end and purpose of Nature, and that it doth so proceede, these two arguments doe necessarily conuince.

First, because in the dilatation there is a certaine and determinate kinde of bloud and ayre drawne perpetually through the same set and determinate vessels. In the contraction likewise the smoky ayre and the spirits are thrust out by certaine vessels.

Secondly, because the flesh of the heart is wouen with all kinds of fibres. If therefore those seuerall fibres doe in other parts some draw, some contract, and some loosen, either they are superfluous in the heart (which to say, is to blaspheme Nature) or else they haue the same vses in the heart that they haue in other parts. We said it proceeded for a certaine end, because this faculty neither worketh voluntarily as the Animall, nor according to the power of the Agent in respect of that which suffereth, but for meere necessity. The stomack, although it be not hungry, yet it concocteth so much meat as is put into it, if it can: but the heart is not moued but as necessity vrgeth, making a pulse either swifter or slower, as the vse of Nature is to haue a flow or quick pulse.

QUEST. III.

Of the manner of the motion of the Heart, and whether it strike the
Brest in the dilatation or in the contraction.

Hus much concerning the cause of the motion of the heart. It followes now to speak of the manner of his motion, which is better knowne by the eye then by discourse of reason: wherefore it is vsuall with Anatomists, for the better obseruation of this motion, to open Dogs aliue, that they may more distinctly see the manner thereof. From this *Anatomy* and witnesse of the eye will we vnfold this mystery.

The third.

Answer.

How the motion of the heart differeth from that of other parts.

The fourth.
Answer.

The diuinity of the Soule.

Multiplicity.

The conclusion.

The manner of the motion of the heart.

There

The 2. motions of the heart.
The double rest how necessary.

There are two motions of the heart. *Dyaftole* or dilatation, and *Systole* or contraction; betwixt each of these is a rest or cessation, one following the distention, the other following the contraction. For it is not possible that two contrary motions should immediately succeed one another: but in the poynt of the refluxion or returne from one contrary to another there must needs be a rest, otherwise there could be no beginning nor end of one motion distinct from the beginning and end of another; and so the motions could not bee contrary which had no distinct beginning nor end particular to either of them, because there is no rest from which the beginning of the motion should arise, or into which the end of the motion should determine: wherefore whatlocuer hath any reflexion, hath also some rest before the reflexion.

An instance in the tyde.

A manifest instance hereof we haue in the Tyde, which when it hath flowed to his height, standeth some small time at a stay before it begin to Ebbe, which stay we call a high water when no motion of the tide can be perceived. But what is done in these contrary motions?

Dyaftole what.

In the *Dyaftole* the heart draweth blood by the gate of the hollow veine into his right ventricle, and ayre by the arteriall veine into the left. In the *Systole* the heart driueth out vitall spirits into the great artery, or fumed and smoky vapours together with a small portion of the spirits, by the venall artery. In the *Dyaftole* the ends of the heart are corrugated and contracted, the Basis being drawne to the *Macro* or poynt, and the poynt to the Basis: so that the heart becommeth shorter in his longitude, but is so amplified to his sides, that his figure commeth neere to the spherical, which is the figure of most capacity. Contrariwise, in the *Systole* the ends of the heart are distended, but the sides fall and flag, as it were, and so the heart becommeth longer, but narrower.

The vse of the fibres of the heart.

Both these motions are performed by the helpe of the fibres, for the right which passe directly from the Basis to the poynte, contracting themselues make the dilatation. The transuerse or circular straightning the sides, doe make the contraction; the oblique serue for retention, and make that double rest whereof we spake. Againe, in the *Dyaftole* all the values are extended, in which distention, the forked values make many chinkes or crannies as it were, but the *semi-lunary* valves do close vp the ends of their vessels. In the *Systole* all these membranes are contracted, and then the forked shutte those chinks and crannies which they made when they were dilated, and the *Semi-lunary* being corrugated or wrinkled, leaue such distances or rifts by which the blood freely passeth forth. Moreover, the dilatation of the heart is before the contraction in time, for ayre is first drawn in before the smoky excrement is shut out: and againe, inspiration must needs be first, because expiration is last, for the life vanisheth in expiration.

Greater vse of expiration then of inspiration.

But whether is of greater necessity? We answer, that in hayle bodies they are of a like necessity. In Agues especially rotten and putrid there is more necessity of expiration, as wee see in those that dye, their *Systole* and expiration is greater, because Nature is more diligent to exclude that which is hurtfull, then to draw that which is profitable; now we know that the ayre that is drawne is familiar to the heart, but the smoaky and sooty excrement is an offence vnto it.

whether the heart striketh the brest in the *Dyaftole* or in the *Systole*. Galens authority.

Lastly, it is questioned whether it strike the brest (which wee feele with our hand about the left brest) in the dilatation or in the contraction. Galen seemeth to differ herein from himselfe: for in one place he saith, *Quando rursus euacuatum fuerit Cor, & in Naturalem figuram reuerterit, tunc proficit pectori, & percussione facit, & ita concidens pulsus per facit*: that is, Againe when the heart is emptied, and returneth to his Naturall figure and position, then it leapeth against the brest, and maketh that percussio, and so falling accomplisheth that pulse.

Reasons to the authority.

To this authority may be added this reason: when the heart is dilated it becommeth short, and againe long when it is contracted. Wherefore when it is distended it goeth from the brest, and when it is contracted it flyeth to the brest, and so striketh it; beside, almost all Anatomists say, that the flesh of the heart is more solid in the *macro* or point, then in the Basis; least that in the violent motions of the brest when it toucheth the bone, to which it is very neere, it should be hurt, and so vitiate his motion; the point therefore striketh the brest, but experience and waighr of reason is on the contrary part.

The consent of Anatomists.

What the truth is.

The reasons to proue it.

The reasons are these: If you lay one hand vpon the brest, and another vpon the wrest, you shall perceiue in either place at the same time the same stroke; and this both Galen hath obserued in the 3. chap. of his 3. Booke *de prasag. ex-puls.* and we daily proue it true by dissections of liuing creatures; but it is most certaine, that the stroke of the artery is in the end of the dilatation

tion, for the end of the contraction cannot be left; therefore that stroke of the heart we feele, is the end of the dilatation, not of the contraction.

It may be obiectioned, that when the arteries are distended, the heart is contracted, and when the heart is contracted, then are the arteries dilated; if therefore you place your hand vpon the wrest or the temples, and there finde the stroke of the artery, and with the other hand vpon the brest finde also the stroke there at the same time, it must follow necessarily, that the hart is then contracted when the arteries are dilated, but the vanity of this obiection shall appeare in the next exercise. For the heart and the arteries are distended at the same time and in the same motion.

Obiection.

Answer with reference.

Moreover, if the heart when it is contracted should strike the breast with his mucro or point, the stroke should not be felt at the left breast but somewhat lower, for the point of the heart reacheth to that place of the chest into which the midriffe is inserted. The breast therefore is beaten not with the point of the heart, but with the left ventricle when it is distended, which is the originall of the arteries; for when the point is gathered to the Basis in the *Diastole*, the heart is made larger, and so striketh the breast at the left Pap; but when it is contracted, the heart becommeth longer and narrower, and so falleth back into the chest, and of this also is *Galens* opinion in his Anatomicall administrations, and in those golden Hymnes of his, of the vse of the parts. Let vs proceed to the other difficulties which concerne the motion of this heart and arteries.

QUEST. IV.

By or from what power the Arteries are moued.



The motion of the Arteries *Hippocrates* first of all others called *σφυγμὸν*, that is, the Pulse, and although hee left indistinct precepts about it, yet was it not vterly vknowne vnto him, as some nouices would beare the world in hand, which may be prooued by many places, if it were necessary to wrastle in that floore: but wee list not insist in that, but proceed. That the forme of the motion of this pulse is all one with that of the heart, for it consisteth of a *Diastole* and a *Systole*, and a double rest.

Hippocrates first found the pulse and so named it.

The forme of the motion.

In the *Diastole* the Arteries draw and are filled, and in the *Systole* they expell. The rest is double, vnlesse Nature be prouoked eyther by a violent obiection, or by some externall cause; for then the arteries may be moued together with an insensible rest, as in the pulse called *Di-crotus* and *vibrans*: so a stone which is throwne vpwrd, if it meet with a falling Tower, descends againe without any rest, although *Aristotle* thinketh that no violence can tie to contrary motions without some rest.

Aristotle.

The vse of this pulsation is double; one greater, another lesser. The greater is for the conseruation of the naturall heate as well of the heart as of other parts: for by contractions whatsoever is smoky the arteries auoyde, and so the naturall heate is kept from suffocation, by dilatation they draw outward ayre into the body, by which the dissolusion of the same heate is inhibited.

The vse of pulsation double.

The lesse vse is, that in the braine may be ingendered the animall spirit, for by the pulsation the spirits of life are carried into the *plexus choroides*. There is therefore the same vse of the pulse that there is of respiration, sauing that what respiration doth to the heart, that the pulse of the arteries doth to other parts, which as they neede lesse heate then the heart, so are they not so soone offended: for if the heart be deprived of respiration, presently the creature perisheth, but the part dyeth not as soone as it wanteth the pulse.

The nature of the motion of these arteries is very obscure, and many things must be resolved of and knowne, before we can attaine to the vnderstanding of so deepe a mystery. First of all, whence are the arteries moued, from themselues or from some other? *Protagoras* thought the arteries did moue of their own accord, and that they had the same pulsative vertue that the heart hath in themselues, not by influence. But this *Galen* disproueth by an obseruation; for saith he, if an artery be cut ouerthwart, that part onely will pulse which remaineth ioyned to the heart; but that which is separated from the heart, will not beate at all.

The nature of their motion obscure. *Protagoras*.

Galen in stance.

Erasistratus was of minde, that the arteries were not moued by any proper power of their owne, but by the constraint of the heart, and that constraint he meaneth not of any faculty but onely of some matter. *Aristotle* thought they moued, because of the feruour or boyling of the blood

Erasistratus.

Aristotle. The reasons.

Neither heat,
nor spirits, nor
blood, are the
immediate
causes.
Not heat.

blood contained in them, whom some haue followed, because they know that the spirits are those which make strife and offer violence; and again, because the veines neere the heart doe not moue, which they would do (say they) if they had in them such blood as the arteries haue: but wee will proue that neither heat nor spirit, nor boiling blood can bee the immediate cause of this perpetuall motion. For the heate, it either hath a body or hath no body; if it had a body, then the arteries that are neerer to the heart would sooneft be dilated; if it be onely a naked quality, then will it first heate those things that are neere hand, and after that which is farther off. For heate is not of the number of those formes which may in a moment be diffused as light, but his contrary is cold, which first must be expelled out of the subiect before it selfe be receiued: but the pulse is in a moment diffused through all the arteries, it is not therefore onely from heate.

Not blood.

It is not of spumous blood; for then it would follow that where the blood is more plentiful and hotter, there the pulse should be not onely more vehement, but more frequent also; and so the pulses of the great arteries should be quicker then the pulses of the small: but experience teacheth, that all the arteries both great and small doe moue alike vnlesse there be some hinderance; they are not therefore moued by the blood contained in them. Furthermore, intercept an artery with a tye, and the part below the tye, though it strut with spirits and thin blood, yet will not beate, because the continuity of the faculty with the heart is intercepted; but as soon as the tye is vnloosed, the artery will instantly beate againe, but neither the heate nor the humor can in a moment or instant flow from the heart into the vter arteries. Adde to this, that if the arteries should beate because of the blood contained in them, then in all large pulses there should also be vehemency, which is nothing so: For saith *Galen* in his Booke *de usu pulsuum*, and in the fourth *de causis pulsuum*, there is a pulse which is small yet vehement, and there is likewise a pulse which is great but languid and faint, which variety cannot come from the heart.

An instance.

There may bee
great, yet a
faint pulse.

Asclepiades his
opinion.

Asclepiades acknowledgeth a faculty in the motion of the arteries; but whereas this motion is in dilatation and contraction, he affirmeth that the distention onely is from the faculty, and the contraction from Nature; that is, from the predominant Element and from the waight, because when the creature is dead the arteries doe fall. So bladders if they bee filled with any thing they are distended, but they fall of themselves: and all round and hollow bodies are dilated by some faculty, but afterward doe fall with the waight of their owne parts. On the contrary, those things that are contracted by any faculty, that faculty ceasing, they are againe dilated. Therefore if the arteries bee dilated by a faculty, then are they contracted by their grauity, and so on the contrary: wherefore they need not a facultie for both.

Herophilus his
opinion.

Herophilus quite contrary will haue the contraction to be performed by a faculty, but the dilatation (saith he) is nothing else but the returne of the artery to his natural position: Because (saith he) the arteries of dead carcasses being cast into hot water, when they haue gotten the measure of heate that they had in the liuing body, will be dilated, but neuer fall, because there wanteth a faculty: but they are both deceived.

How both
were deceived.

For if both the *Diastole* and *Systole* came not from the faculty, but from the constitution of the artery, then the artery should euer keepe the same magnitude, and the same vehemency of pulsation; but we see that the pulse is now greater, now lesser, as the strength is great or little; sometimes the *Systole*, sometimes the *Diastole* is greater, as the vse of either is increased. There want not some who strive to proue that the motion of the arteries is from the braine, standing vpon one authority of *Galen*, where he saith in the 2. Book *de causis pulsuum*, When in a man the pulse beginnes to be convulsive, presently he is taken with a convulsion, which seemeth to intimate, that there is one original of the faculty of pulsation, and of that to which convulsion doeth belong. But *Galen*s owne obseruation bewrayeth the vanity of this opinion. For if the braine be compressed, sence and motion will perish, but the arteries will stil beate. If the nerue which commeth from the braine to the heart be cut or intercepted, the creature becommeth dumbe, but the arteries beate still.

That the mo-
tion of the ar-
teries is not
from the
braine.

The true cause
whereby the
motion is mo-
ued.

Seeing therefore that the arteries neither moue by a power of their owne, nor from the Elementary forme, nor onely from heate, nor from a spirit or spumy blood, it remaineth necessary that they should be moued by a pulsatiue power of the heart. For if they should be moued by any thing saue by a faculty, their motion should be not continuall but violent: neither would there be any attraction of ayre in dilatation, but the boyling blood would take vp all the roome.

This

This Faculty or power pulsatiue is in a moment carried, not through the Cautie but along the coats of the Arteries; and that it is carried in a moment this is an argument that all the Arteries are mooued with the same motion, all together in the same time when the heart is mooued. If it be obiected, that *Galen* (in the 1. *de different. pulsuum*, and 2. *de prima cognitione ex puls.* speaking of those that haue hot hearts, and cold Arteries, in whom the parts of the Arteries that are neerer to the heart are dilated sooner then those that are more remote) is constrained to confesse, that the pulsatiue power is mooued through the artery and slowly by degrees. I answer, that the faculty floweth in a moment vnlesse it be hindred. But it may bee hindred sometimes by his owne fault, sometimes by the fault of the Instrument; by his owne when the heart is weake, by the Instrument when the Arteries are either cold or soft or obstructed. It remaineth therefore, that when all things are aright disposed it floweth in an instant, and not through the Cavity, but along the coats of the Arteries. *Galen* in the last Chapter of the Booke *Quod sanguis Arterijs detineatur*, giueth an instance from experience. If you put a Quill or Reede into the Arteries, which will fill the whole cavity, yet will the Artery beate; but if his coats be pressed with a Tie, it will cease instantly. If it bee obiected that the Arteries in an Infant beate before the heart, and therefore the pulse is from the spirit, not from the heart: I answer, that the Infants Arteries do mooue by a vertue that proceedeth from the heart of the Mother: for the Arteries of the Infant are continuall with those of the Mother, and receiue as well life and the pulsatiue Faculty from her, as the Liuer and all the other parts do nourishment.

Which way the Faculty is led.

What may hinder the motion of the heart.

An instance for experience.

Obiection. Solution.

QVST. V.

Whether the Arteries are dilated, when the heart is dilated, or on the contrary then contracted.

Here ariseth now a more obscure, thornie, and scrupulous question, then the former, and that is, whether the Arteries and the heart are mooued with the same motion. For the explication whereof, we must first resolue that the Arteries are filled when they are dilated, and emptied when they are contracted, that they draw when they are dilated, and expell when they are constringed. The reason is manifest; For the vessels must needs draw with that motion whereby they are made most fit to receiue; but the vessels by how much they are more enlarged by so much are they more capeable: now they are enlarged by dilatation; therefore, when they are dilated they draw and are filled: so that *Archigines* is no way to be harkned vnto, who was of opinion that in the *Systole* the arteries doe draw and are filled, and in the *Diastole* do expell and are emptied; whose argument for this was, because in inspiration the lippes are streightned, and the Nostrils contracted: but whether this *Diastole* of the Arteries bee at once and together with the dilatation of the heart, that is indeed a great controuersie. *Erasistratus* was the first that thought their motions contrary, that is, that when the heart is dilated, the Arteries are contracted; and when the heart is contracted, the Arteries are dilated.

Adifficile question.

The Arteries are filled in their dilatation.

Archigines

The first opinion. Erasistratus.

Authorities

Reasons. The first.

Amongst the new writers, these haue sided with him: *Fernelius*, *Columbus*, *Cardane*, and *Scaliger*: and truely his opinion may be confirmed by authorities and reasons. *Galen* in his Booke *De Puls. ad Tyrones* saith, that the Vitall Faculty doth mooue diuers bodies at the same time with diuers motions, which can bee vnderstood of nothing else but the motions of the heart and of the arteries. *Auicenna* *Fen. 1. cap. 4. doctrin. 6.* affirmeth, that the vitall Faculty doth together dilate and constringe. The reasons beside these authorities are: In the *Diastole* the heart draweth blood by the hollow veine into the right Ventricle, and aer by the venall artery into the left. Therefore at that time the heart is filled, and the vessels are emptied. Contrariwise, in the *Systole* the heart expelleth the Vitall spirit into the arteries; therefore at that time the heart is emptied and the arteries are filled; but when the arteries are filled they are distended, and when they are emptied they fall: wherefore when the heart is distended, the arteries are contracted, and when it is contracted they are distended. Beside, there is the same proportion betweene the arteries and the heart, which there is betweene the heart and the deafe eare: but it is most certaine, which our eie-sight reacheth vs, that the motion of the heart, and of the eares of the heart are diuers; for when the heart is dilated, then those eares doe fall; and when the heart is contracted, then they are distended and filled: wherefore the heart and the arteries are mooued with a diuers motion.

The second.

Na

Thirdly,

The third.

Thirdly, as attractions and expulsions are in other parts, so it is likely they are in the heart; but when the stomach driueth out the Chylus, the mesentery veines do draw it, and therefore when the heart driueth out bloud and the vitall spirit, then the arteries draw it; and so their motions are contrary.

The fourth.

Fourthly, when the heart is dilated then becommeth it shorter, and draweth vnto it selfe the arteries that are continuall with it and therefore maketh them narrower, but when the heart is contracted the arteries are dilated and become longer.

The fifth.

Lastly, if one hand be placed vpon the brest and another vpon the wrist, the same stroke will at the same time be perceiued; but the stroke and percussio of the brest is done by the contraction of the heart, for when it is contracted it commeth to the brest and striketh it: but when it is distended it becommeth shorter and recedeth from the Chest. Now the stroke of the Artery is not from the contraction, but from the dilatation. Wherefore the heart and the Arteries are moued with a diuers motion. But not withstanding all these reasons, yet are we perswaded with *Galen* in his booke *de vsu puls.* and *3. de presag. expuls.* and *6. de vsu partium*, that the heart and the Arteries are moued with the same motion. And this we are taught first by experience, then by strong and inuincible force of argument. The

The truth it
selfe proued
by

Experience.

experience is instanced by *Galen*, which every man may make tryall of in himselfe. If one hand be laide vpon the brest and another vpon the wrist, the same stroke will bee perceiued at the same time; and besides in dissections of liuing creatures wee haue often obserued the very same. But beside, these reasons doe euince it. We haue already proued that the arteries are not moued by the impulsio of the blood, nor by the boyling or heate of it, but by a faculty and that not of the Arteries but yssuing from the heart; therefore they are contracted by the faculty which contracteth the heart, and distended by the same force and power by which it is distended. But if they were moued with diuers motions, it would follow that the dilating faculty must flow from the heart in the same moment wherein it is contracted, which no Philosopher will dare to admit. Beside, that motion is the same which hath the same efficient and finall causes: but the pulsatiue power is the same which moueth the heart and the Arteries; and the end also is the same, to wit, nutrition, temperation or qualification, and expurgation.

Reason.
First.

Second.

Third.

An instance.

Thirdly, the motion of the part and of the whole is all one; and a part of that beeing moued which is continuall with the whole, the whole is moued: as is seene in the strings of Instruments: but the Arteries and heart are continuall together; wherefore if they be moued by the heart as is most euident, then will it follow necessarily that they shall both bee moued together by the same motion.

Fourth.

Fourthly, vnlesse the heart and the Arteries were together distended and together contracted, the heart should not bee refrigerated in his dilatations, because the Arteries being contracted there would follow an exclusion of the smoky excrements into the left ventricle, and so the heart and the artery should mutually strue, and their motion be in vaine.

Fifth.

Fifthly, it would follow that in the contraction the heart should draw ayre from the dilated and distended arteries. For sometimes the vse of respiration being taken away, as in passions of the mother, the heart doth not draw ayre from the Lungs and the venall artery, because then no ayre is drawne in by the mouth and the nostrils, yet the heart moueth and the arteries beate. Now it moued for the generation of vitall spirits, but this generation is not without the admision of ayre: it draweth therefore ayre from the arteries not contracted because then are the excrements expelled, but from the arteries distended. But if when the arteries are distended the heart be contracted, then the contracted heart shall draw from the distended arteries, and so shall the motions of the heart become contrary.

Sixth.

Sixthly, this faculty is incorporeall, communicating it selfe in a moment: wherefore at what time the heart beginneth to dilate, it distendeth all the arteries, and so on the contrary.

Seventh.

Finally, the pulses which are in anger, sorrow and other passions doe sufficiently shew that the heart and arteries are moued with the same motion. For, if when the heart is dilated the arteries should bee contracted, then in anger the pulses should bee small, in griefe great; because in anger the heart is somewhat contracted and therefore the arteries should bee but a little dilated. Contrariwise, in griefe the arteries should bee very much dilated because the heart is strongly contracted: but how false this is, common experience will witness. Let vs therefore settle our selues in *Galen*'s opinion and determine, That the arteries are dilated and contracted when the heart is dilated and contracted.

What decei-
ued the for-
mer learned
men.

The structure of the vesselles of the heart, deceiued those learned men which hold the

con.

contrary opinion, together with the obscure maner of the hearts motion. For there being in the Basis of the heart foure notable vessels: the hollow veine, the arteriall veine, the venall artery, and the great artery: they imagined that the heart in his *Dyaſtole* did draw something from those foure vessels, and in his *Systole* drive something into them all; and that therefore in the *Dyaſtole* of the heart they were all emptied that the heart might bee filled, and in the *Systole* of the heart they were all filled because the heart is emptied.

Beside, they seeme to haue beene ignorant of the efficient cause of the motion of the heart and the arteries. For they would haue the heart and the arteries to be dilated, because they are filled with ayre or blood. But the truth is, that the arteries are not dilated because they are filled, but because they are dilated therefore are they filled: onely the power and pulsative faculty which floweth from the heart distendeth the arteries, not the blood contained in them. For whether they be distended or contracted they remayne alwayes full of blood: but if you shall thinke that they are distended because they are filled, then will it follow that at the same time they cannot bee all distended; for how can that corporeall blood bee carried in a moment from the heart to the arteries of the foote? I will giue you for illustration of this matter an elegant example. The smithes bellows because they are dilated are therefore filled with ayre; and the chest because it is distended by the animall faculty is presently filled; but purses, bagges and the hogges bladder, with which boyes often play themselues, are distended because they are filled.

But wee must carefully marke, that whereas there are foure vessels of the heart, onely the arteries are filled because they are dilated: the other three are distended because they are filled, and doe fall because they are emptied; because onely the arteries haue the motion of *Systole* and *Dyaſtole* from the faculty of the heart, the other vessels are immonable. And this is the reason why when the heart is contracted, the left eare is dilated, because the eare is a kinde of store-house of ayre and blood which suddenly rush into it; from the which when the heart draweth blood or ayre, it is of necessity that it should contract it selfe.

These things being determined, it will bee easie to make satisfaction to whatsoever is objected on the contrary part. The authorities of *Galen* and *Auicenna* are not contrary to our determination, for they call the heart and the arteries diuers moouable bodies, which at the same time are mooued with diuers motions; for they are dilated and contracted at once and together by the same vitall faculty. And I imagine that *Galen* and *Auicenna* spake this against the ancients, who sayde that onely the dilatation was from the faculty, but the contraction from the Elementary forme and from the waight of their bodies. The reasons are thus to bee answered. The arteries are not distended because they are filled but are filled because they are distended; neither doe the arteries fall altogether when they are contracted but reayne still their cavity; and the plenty of the matter is more which issueth from them, then that which is receiued into them: the arteries therefore are not dilated by the influence of the matter which goeth out of the heart.

The second argument is of no moment: for there is not the same reason of the heart and the eares thereof; for the eares expell nothing, but the arteries expell more at that time then they receiue; beside, the eares are dilated because they are filled, but the heart and arteries are therefore filled because they are dilated: and this did *Hippocrates* silently innuuate where he sayth, The heart is mooued by his whole Nature; that is, by his proper faculty: but the eares doe priuately swell and fall againe; that is, as they are filled or emptied of ayre and blood.

To the third reason we thus make satisfaction; in other parts the attractive and expelling vertues are in-bred, but contraction and dilatation the arteries haue by influence.

The fourth reason instanceth but in a light contraction, which is into length not into breadth.

Last of all, the last reason is against experience, for wee haue before proued that the breast is beaten in the dilatation, the left ventricle being largely displayed.

What the truth is.

The arteries in both motions are still full of blood.

A fit example.

The former distinction concerneth onely the arteries.

Why the left eare is dilated when the hart is contracted.

Satisfaction to the authorities alledged.

The reasons answered.
The first.

The second.

Hippocrates de Corde expounded.

The third.

The fourth.

The last.

QUEST. VI.

Of the generation of vitall spirit, and by what wayes the bloud goeth out of the right into the left ventricule of the heart.

Of the vitall spirits.

WEE haue hitherto proued that the motion of the heart and the Arteries is one and that a perpetuall motion, consisting of a *Systole* a *Diastole* and double rest, arising from a naturall pulsatiue faculty of the Soule residing in the heart, there assisted by the structure of the fibres and thence deduced by influence or irradiation into all the arteries at one instant, not through the cavity but along their coates. Now because all this curious and maister-peece is wrought by Nature, onely for the generation of vitall spirits, it is more then requisite that we vnderstand what this spirit is, and how generated. We will not trouble you with many things hereabout, but those we will insist vpon shall not bee triuiall and ordinary, but hewne out of the deepe quarries, vnueyled from amongst the most secret mysteries of Nature. That there is a vitall spirit in perfect creatures no man euer denied. *Hippocrates* in his Booke *de Generat.* and *de principiis* first put vs in minde of it, *Galen* hath a thousand times inculcated the same.

All physicians agree that there is a vitall spirit.

The prince of the Arabian tribe *Auicenna* hath set his seale vnto it; and all the multitude of Greeke and Arabian Physicians haue added their suffrages. And amongst the later writers, though some haue doubted concerning the Naturall and the Animall spirits, yet all with a ioynt consent allow of the vitall. There is therefore a vitall spirit which is primarily seated in the Left caue or denne of the heart as it were in a shoppe or work-house; and from hence it is diffused by the arteries as by conduits or pipes into the whole body. This spirit cherisheth the in-bred heat of every part, quickens it when it becommeth drowsie, bringeth it forth when it lyes hid, and being spent or wasted restoreth it againe.

The office of this spirit.

This spirit whilest it shineth in his brightnes and spreadeth it selfe through all the Theater of the body, as the Sunne ouer the earth, it blesteth all partes with ioy and iolitic and dies them with a Rosie colour; but on the contrary when it is retracted, intercepted or extinguished, all things become horrid wanne and pale, and finally doe vtterly perish. So wonderful and almost so heavenly are the powers of the heat and spirit, that the diuine *Seneca* applying himselfe to the rude capacity of the people (as *Galen* witnesseth, hee sticketh not often to doe) calleth it the Soule, that is, the chiefe instrument of the Soule.

Hippocrates, called the spirit the soule.

The Soule of a man (saith he) is seated in the left ventricule and is nourished not by meates or drinkes from the lower belly, but by a most pure and bright substance out of the separation of the bloud; as if hee should say, it is creamed as it were off from the bloud, and by the heat of the heart rarified into an aethereal consistence. For the Soule it selfe being a denison of heauen (*τὸ γὰρ καὶ γένος ἑσπερίον*, for wee are also of his generation) how could it be tyed to this house of clay vnlesse it were by the mediation of some middle Nature, participating (as neere as mortality will suffer) of the purity of the Soule and yet hauing his originall from the body, that the Soule might haue a nimble and agile instrument to follow her sudden designs.

Paul. The spirit is the medium betweene the soule and the body.

By the Soule therefore in this place, *Hippocrates* meaneth the vitall spirit, which is nourished with pure and attenuated bloud, that is, restored; for therein lyeth a mystery: that the nourishment of the spirit is not, in all things, like the nourishment of the parts, but rather is an illumination, vnition and establishment of them, as we shall heare afterward.

The vses of the vitall spirit within & without the heart.

The vses of this vitall spirit are according to his nature diuine also, both within and without the heart. In the heart to be the principall instrument of the functions of the heart; without the heart his vse is double: one to bee the subiect of the heat of the heart which wee call *Calor influens* the influent heate, which it may receiue as the ayre doeth the light and so exhibite it to the whole body; and the other to bee the matter of the Animall spirit.

His matter double.

This vitall spirit hath a double matter aery and sanguine, for it is made (as *Galen* saith in his seventh Booke *de placitis Hipp. & Platonis*) of aer and bloud mingled together. That it is made of aer *Hippocrates* taught in *Epidemiis* when he saith; Such as is the aer such are the spirits; a foggie and cloudy aer engendreth a grosse and dusky spirit: and againe *Hippocrates*; The South winds dull the hearing, they are misty and breed a dissolution of the spirits. this

Ayre.

Their aery substance alone cannot contain within the body the vitall heat; It is necessary therefore that there should be an admision of thin and subtile blood which should restrain the impetuous force of the ayre. And both these matters before they come vnto the left ventricle of the heart stand in neede of preparation. The ayre drawne in by the mouth and the nose is prepared in the Lungs his vessels and his whole soft rare and spongie substance; and by a long delay doth acquire a qualitie familiar to the in-bred spirite. This aire thus prepared, is conueyed by the venall Artery into the left ventricle. And this is the preparation of the ayre, these the passages by which it is conducted to the heart.

Concerning the preparation of the blood, in what place it is made and accomplished and by what waies it is deriued into the left Ventricle, the Anatomists do strue with implacable contention. I haue read and turned ouer many of the Monuments both of the Ancients and also of later Writers, and I finde foure opinions euerie one repugnant to another.

The first and the ancient is that of *Galen*. Hee thinketh, that the blood is carried through the Hollow veine which with an open mouth gapeth into the right ventricle of the Heart as into a Cisterne, and is there boyled attenuated and subacted, and then a part of it is sent by the arteriall veine into the Lungs and distributed into them for their nourishment, the remainder is carryed through the middle partition, which like a wall seuereth the two Ventricles asunder, into the left, where it is by the in-bred vertue of the heart mingled with the ayre and doth there acquire the forme of a vitall spirit, assisted partlie by the in bred spirit of the heart, partly by an exceeding heate and flame whereby it is wrought as in a Furnace into a more pure Elementary forme. This opinion of *Galen* which of all the rest is most true, some of later times haue condemned. For they do not thinke it possible that in so short a time so great a quantity of blood as is sufficient for the generation of vitall spirits for the vse of the whole body can sweate thorough the wall of the heart into the left ventricle, there being no apparant and sensible passages, and the wall also being very thicke and solid.

Morcouer they obiekt, that if it should bee so, then the labour of the heart were vaine and idle; for why should not the blood and ayre being thus attenuated repasse againe out of the left into the right, seeing the same way is open for them, the same passages and no valves or gates to hinder it? But these Obiections are of lesse weight then that they should weaken the authority of so great an author of our Art and *Galen* himselfe foresaw (in the 15. Chap. of his 3. Booke *De Facultatibus Naturalibus*) that there would bee some which would make their childish Obiections. Wherefore in another place hee thus elegantly explaineth himselfe. Out of the right Ventricle that which is the thinnest is drawne through the pores or passages of the partition, whose vtmost ends can hardly bee perceyued, because after death all such yea all other passages that are not distended by the matter contained in them, doe fall together. But that it is this way transmitted hence it is manifest, because Nature neuer endeouureth any thing rashly or in vaine; but there are certaine dens in the fence or partition, deep bosomes very many which grow narrow to their outlet, by which the blood may freely and with a large streame yssue out of one ventricle into another. But the cause why this blood doth not returne againe out of the left into the right side, may bee well referred to the peculiar force and vertue of the heart.

The left Ventricle drawes this blood and retaineth it by an in-bred propriety and for a while enjoyeth it, and then thrusteth it forth into the Tunnels of the arteries. So the blood which either hath sweate through the coates of the veines, or is powred forth at their mouths into the substance of each part, returneth not into the veines againe because it is reteyned and receyued into the substance of the part. The truth of this opinion, albeit it be most cleare of it selfe, yet it will be better manifested vnto vs after we haue taken knowledge of other mens conceites and discussed them to the full.

The second opinion therefore is that of *Columbus*. That the blood indeed is attenuated and prepared in the right Ventricle of the heart, but is carried into the left Ventricle by other passages and not through the pores of the Fence or partition. And what neede wee seeke for so smal and secret pores, when it hath an open channell, the arteriall veine, which (saith hee) carrieth all the blood out of the right ventricle into the Lungs, where a part of it is distributed for their nourishment, the rest is returned into the venall artery and from it together with the ayre into the left ventricle; and this opinion of his he strengthneth with two reasons. The arteriall veine (saith he) is greater then was necessary for the nourishment

Bloud.

How & what the aery is prepared.

How the Bloud is prepared.

4. Opinions.

The first and trust of *Gale*.

Obiections.

Galen himselfe explained by himselfe.

The second opinion of *Columbus*.

ment of the Lungs, it is therefore like that it was destinated also for the conueiance of the blond of the generation of the vitall spirits. His other reason is this : there is alwayes in the venall artery thinn and arteriall blood ; this blood is receiued not from the left ventricle, for the three-forked Membranes will not suffer it; therefore frō the veine of the Lungs.

The answer
to Columbus
his
First reason.

These things are very probable and clogged with the veile of truth, yet not to bee admitted for currant. For whereas he saith the veine of the Lungs is larger then their small body stands in neede of, we vtterly deny it. For the rare lax and spongy substance of the Lungs is easily dissipated, it is also continually moued, and by reason of the neighbourhood of the heart is easily inflamed ; whence comes a huge expence of the threefold nourishment ; but where there are great goings out, there also had need be great commings in : now the blood could not come plentifully in but by a wide vessell, therefore the vessell of the Lungs was of necessity very ample and large. Besides saith *Galen*, Nature made this vessell large, that how much was abated in the nourishment of the Lungs by the vessells thicknesse, so much might be recompenced in his amplitude and largenes.

Lib. 6. de usu
part. cap. 10.

To the second.

To the second reason we may answer thus : The blood that is found in the venall artery is a portion of the vitall spirits and arteriall blood which the heart poured forth into the substance of the Lungs : for all life being from the heart and the vitall spirit, and no deriuations of vessells from the great arterie vnto the Lungs ; it is likely yea necessary that vitall spirits should bee conueyed to the Lungs by the venall artery, neither is there any reason they should object the opposition of the three-forked Membranes; for there are but two in the orifice of this vessell, because it behooueth not that it should bee perfectly closed vp. Happly they may object the contrary motions and the mixture of smoky vapor with the spirits, but they attribute very little to the wonderfull prouidence of Nature and are ignorant what the diuers appetites and attractions of particular parts can do. The veins of the mesentery do together and at once distribute Chylus and blood : Milke passeth sometimes out of the brest all along the trunke of the hollow veine, yet is not mingled with the blood, but passeth out by vrine pure and sincere ; and as we shall by and by proue, the matter and quittance of those wee call *Empyici* is purged by the left ventricle of the heart and so through the arteries into the kidnies and the bladder, yet is not the vitall spirit stained with this filthinesse if all things be in good order with the patient : and so much for *Columbus*.

An objection.
Answer.

Pure milke a-
noyed by
vrine.

The third o-
pinion of *Bo-*
tallus.

The third opinion is that of *Iohn Botallus*, the french Kings Physition, who boasteth that he found a passage open which no man euer knew, out of the right deafe eare into the left, by which hee imagineth that the blood prepared in the right ventricle passeth into the left. This he saith is very euident in Calues and other young creatures, but in men and creatures that are growne, it is not so open.

Confuted.

This opinion of *Botallus* hauing no reasons to establish it, ouerthroweth it selfe ; for if Nature made this passage for this vse, to transfuse the blood from the right ventricle vnto the left ; then should it bee manifest in all creatures in all times of their life, yea the creature growing large and the naturall heat daily increasing, the passage also should grow more manifest as whereof there is euery day greater vse. But *Botallus* confesseth it is not found in Oxen nor creatures of any growth.

Beside, this passage is in the orifice of the hollow veine, how therefore should the attenuated blood flow backe from the right ventricle vnto the veine, seeing there are three valves open without and shut within, which doe admit the blood indeed into the right ventricle but will not suffer it to flow backe into the hollow veine ? This good honest man was ignorant of the vse of his passage, which *Galen* accurately describeth first of all men in his golden bookes of the vse of the parts.

Botallus igno-
rant of the
vse of the
passage he
thinks hee
found.

My selfe haue seene this passage very often with the other arteriall pipe, but they serue onely for the Infant before it bee borne, because his life and nourishment is much vnlike to that it is afterwards, and therefore after the birth the passage is altogether shut ; and the pipe so dried vp that a man would deny that euer any such thing was ; the vse of this passage & pipe wee haue at large described above, and thither doe wee transmit the Reader that is not satisfied concerning them.

The fourth
opinion of
Vlmus.

The last opinion of the preparation of the blood, is that of *Vlmus* a Physition of Poyton, who set out a very elegant booke of the spleene. He is of opinion that the arteriall blood is concocted, attenuated and prepared in the spleene, and thence conueied into the great artery and so to the left ventricle of the heart, where, by an admirable and mysticall worke of Nature it is mixed with the ayre already prepared by the Lungs. I must needs confesse

that

that the opinion of *Plinius* pleased me wondrous well, both for the nouelty of the conceite, as for that he handled the matter with great subtilty of argument, and deepe discourse; but because he leaneth vpon vnfound foundations to establish a newe doctrine, which doe shadow the brightnes of the Art of Anatomy, it will not be amisse to recal the principal points of it to the touch-stone in this place.

A subtile disputation.

First of all, hee thinketh that the blood cannot passe out of the right ventricle into the left by the fence or partition, because (saith he) if this way were not sufficient in a tender Infant in whome the vessels are more laxe and the substance of the wall more rare and thinne, and wherein there is lesse dissipation or waste of spirit; then surely it will much lesse suffice in an older man: but this way is not sufficient in the Infant, so that nature provided another; to wit, two arteries, which are carried from the Navel to his crural arteries. Therefore in a growne man it is necessary there should be other more open passages.

An argument truly most subtile, but most false and stuffed with error: For in the Infant, the blood doth not sweate through from the right ventricle to the left, because there is no generation of vitall spirits in the ventricles of the heart; but the Infant draweth the mothers spirite by the vmbilicall arteries, which is diffused into all the streames of the great artery. The Lungs are not nourished with pure and thinne blood but with thicke, carried vnto them by the hollow veine; wherefore from that hollow veine to the venall arterie there is a cleare passage, and a conspicuous pipe from the great artery to the arteriall veine, by whose interposition the vessels of the heart in the Infant are vnited.

Answer to Plinius.

The opinion therefore of *Plinius* is false, because in the Infant there is no shop of the spirits, neither doth the orifice of the hollow veine powre out blood into the right ventricle of the heart; for that, as *Galen* sayth in the 15. Chapter of his 6. Booke, *de vsu partium*, the Lungs in an Infant are redde, dense and immouable, and are nourished with thicke and grosse blood.

Secondly, the membranes placed in the orifice of the great artery (which hee calleth not well *three-forked*, for the valves of the hollow veine and the venall artery onely are three forked, the rest are *semicircular*) he doth not imagine are made to that end that they should prohibit blood for going out of the great artery into the heart; because while the Infant was in the wombe, they hindred not the arteriall blood from entring into the left ventricle of the heart. But here *Plinius* offendeth at the stone at which he stumbled before, for nothing floweth into the ventricles of the Infants heart by his foure orifices. Not blood by the hollow veine, for what neede is there of his attenuation, when the Infants Lungs are nourished with thicke blood? Not ayre by the venall artery, for the Infant breatheth not in the womb. Not arteriall blood by the *Aorta* or great artery, for this labor were vaine, because in a moment it should bee thrust backe into the same *Aorta* againe: adde to this that there should haue beene no neede of that arteriall canale or pipe going from the great artery to the arteriall veine, vnkowne to thee *Plinius* as I see, and almost to all Anatomists.

Nothing goeth into the Infants heart out of any of the vessels.

Thirdly, whilest *Plinius* assenteth to *Botallus*, and fashioeneth to himselfe a peculiar vse of that hole or passage, he walloweth in the same puddle with him and deserueth the same reproofe *Botallus* had. In confuting of *Columbus* he is most subtile, at length hee bringeth to the birth his witty conceite which hee trauelled with, and after many sharpe throws and pinches is deliuered of it. To wit, that in the spleene the arteriall blood is prepared, because the spleene is made as it were of a woofe and web of veines and arteries inexplicably woven together: that when it is so prepared, it is sucked away by the arteries and carried into the trunk of the great artery, and so into the left ventricle of the Heart: but there be indeed many obstacles which will hinder this ready passage if wee will but stay a while and follow the streame a little.

Plinius opinion

How it can not be true.

First of all, in the orifice of the great artery there are three membranes shut without against it, so that by them the arteriall blood cannot passe: This our very eyes teach vs, and beside our great Dictator, in his Booke *de Corde*, hath in direct wordes deliuered the same. *Plinius* I know also will deny this vse of the valves; and yet I know also hee will not say that Nature formed them in vaine. I say then, that if they doe not altogether interclude or hinder the egress and regress of the blood; yet as hee himselfe is constrained to confesse, they break and stay the abundant and violent influence of the same; which if they doe, then cannot the whole matter of the vitall spirits bee brought from the spleene by the great artery vnto the left ventricle of the heart; because seeing the generation of the spirits must bee sudden and abundant, their matter also had neede to bee ministred with a full streame

Hippo. de Cordo.

fireame, and not drop or sipe by degrees into the heart. Furthermore, in the structure of the heart this is one point of Natures excellent worke-manship, that it draweth by one vessel, and expelleth by another. It draweth blood by the Hollow-veine, the same it expelleth by the arteriall veine; it draweth ayre by the venall artery which it mingleth with the blood, & expelleth the vitall spirit into the great artery; but if by the great arterie it should draw the matter of the spirits, and almost in the same moment should expell the spirit into the same great artery againe, there would be a mixture of those iuices, & in the arteries would there also be perpetuall two contrary motions, one of the blood, ascending from the spleene to the heart, another of the arteriall blood descending from the heart to the spleene, which as wee admit may bee sometimes in criticall euacuations and in notable Maister-prises of Nature, so we deny it to be perpetuall; but the generation of spirits is perpetuall.

Obiection.

Vlinus will object, that the venall Arterie leadeth ayre vnto the heart, and shutteth also out into the Lungs smokie vapours, together with some portion of blood: but wee answer, that there is not the like reason of ayre and of blood. Aire by reason of his subtiltie and finenesse can passe through the blood and the coats, which blood cannot do.

Answer.

An argument.

Moreover, if the Arteriall blood be prepared in the Spleene, and not in the right ventricle of the heart as *Galen* thought, why doth the Hollow veine open into the heart with so wide a mouth? Was it onely for nourishment of the Lungs? No verily, for the orifice of the Hollow veine is much larger then the orifice of the arteriall veine, as *Galen* saith in his 3. Booke and 15. Chapter *De facult. Natural.* Was it for the nourishment of the heart? Nothing lesse. For the heart hath a peculiar veine, called the Crowne veine by which it is nourished; therefore that patent orifice of the Hollow veine at the right ventricle of the heart, was ordained to cast in the seede of the spirits into the womb of the heart, whence they are forced and sent out into the little world of the bodie. Finally, from hence I gather, that the Spleene was not ordained for the preparation of the Vitall spirits, because the Spleene is very subiect to obstructions, not by reason of his vessels which are very ample and large, nor by reason of his *Parenchyma* or flesh which is rare & spongie, and therefore by reason of the foeculent and muddie humour contained in it: but how shall it serue for the expurgation of the drosse of the blood and for the preparation also of the same blood? We therefore conclude, that the blood is prepared in the right Ventricle of the Heart and thence is deriued into the left by the holes and nooks of the partition wall.

why the spleene
cannot pre-
pare the blood
for the heart.

The conclu-
sion.

QUEST. VII.

Whether the Matter and Quitture of those that are called Empyici may be purged by the left Ventricle of the Heart and the Arteries, and how it is purged by the Vrines, by the Seidge and by Apostemation.

His Question hath wrung the wittes of many Schollers a long time, notwithstanding according to the meane modele of our wit, we will heere, if it may be, vntie that knot. Wee call those *Empyici* with *Hippocrates*, who haue an impostume (as wee call it) or a bladder broken in the side of the Lungs, the matter of which is powred out into the cavity of the Chest, and there is kept and floweth vp and downe, so that with the impurity of it the Lungs are as it were laid in sleepe.

Who be *Empyici*.This quitture
may bee pur-
ged 4. waies.The easiest
way.The other 3.
wayes.

By Vrines.

An instance.

This purulent matter, according to the doctrine of *Hippocrates* may be purged 4. waies; Vpward by the mouth, by the Vrines, by the Seidge and by Apostemation. The vpward excretion is by a proper motion of the Chest, casting that which is noisome with a strong contention out at the mouth. This is familiar to Nature, and the way which wee alwayes desire Nature should take, for it is by places naturally commodious, & witnesseth a strong force and power of all the Faculties. And this is the proper *Crisis* of the *Empyici*, of those that haue pleurifies and inflammations of the Lungs: and this is the best and the safest way. But if Nature be insufficient to mooue this way, either by reason of the thicknesse of the matter that yeeldeth not to the concussion of the chest, or because of the weaknesse of the Muscles: Then Nature is so wise and prouident that she openeth another passage, findeth out some other way by which she may ease her selfe both of the disease, and of the cause of it. Therefore, oftentimes she purgeth this purulent matter by the Vrines, sometimes by Apostemation, sometimes but rarely she emptieth it by the seidge.

That it passeth away by the Vrines is prooued by daily experience, and euen now whilst I am writing these things, Nature hath found this very way in an olde Gentleman a Law-
yer,

yea, who hauing had a Pleurisie, and no meanes of bloud letting or almost any other of any moment, is beholding to Nature, who daily in great and notable abundance venteth this noisome humor by the Vrine. But beside experience, it may also bee confirmed by the authority of very many as well ancient as later writers. Hippocrates and Galen are very plentifull witnesses of it: wee will onely quote the places in them, and thither referre the Reader for his better satisfaction. Hippocrates lib. 1. Epidem. sectione secunda, twice in that section. Lib. 3. Epidem. sect. 3. Galen lib. 6. de locis affectis. Cap. 4. Comment. ad Aphorif. 75. sec. 4. We may add to these if it were needefull, Auicenn, Paulus, Mesues, and many others.

Thirdly, this matter is purged by the Seidge, but Hippocrates, saith, It is very dangerous, yea mortall. Galen in his Commentary vpon Hippocr. de Coacis, It is a wonder (saith he) that Quitture or purulent matter should flow downe from the parts aboue the Midriffe into the belly, that is into the guts. Fourthly, this matter is purged by Apostemation (Physitians call that per abscessum) either of the lower or vpper parts. Hippocrates saith in Porphet. From a Peripneumonia or inflammation of the Lungs Apostemations doe breede vnder the eares, or in the lower parts and do there suppurate, and those men are deliuered from the disease. And againe in Coacis, Those apostemations that descend vnto the Thighes in such as are troubled with the Peripneumonia, are all of them profitable.

Thus many wayes therefore are numbred by Hippocrates, by which the purulent matter of the Chest is by Nature euacuated, first by the mouth, secondly by the kidnies, thirdly by the guts and lastly by Apostemation or abscesse. The first is safest and therefore chiefly to be desired, next that which is by the Vrine, for it bringeth least labour or trauell to the frame of Nature, that is to the due disposition of the bodie: onely it is troublesome, because it is painefull, as being accompanied with a Strangurie, yet not that continuall, but catching as it were and by turnes. That which is by the guts is the worst of all, for it breaketh or dissolueth the Faculties of the stomack, as well of Appetite as of Concoction, and of the guts also with his noysome stenche, and beside by the acrimony and ill quality of the matter, causeth an incurable bloody Flix. But that euacuation, which is by apostemation is profitable, if so be it fall into the lower parts, both because it is far remoued from the first diseased part, and also because that kinde of excretion is as the Physitians sayes, *αἰσίων* *περιβολῆς*, a conuenient kind of euacuation, and proportionable both to Nature and to the disease. For a lawfull Apostemation ought neither to be *ἡμίσπορος* nor *ἀνδροπορος*, that is, neither ought part of the matter flow to the place of Apostemation, but all; nor all take way vppward but downward onely; for to ascend is against the nature of the humour, and argueth alwaies a gadding quality therein. Ariteus in his Book de Morbis Chronicis addeth, that in women sometimes this purulent matter of the Chest commeth away by the wombe. Thus we haue declared all the manners of Natures worke in the euacuation of noisome humors out of the cavity of the Chest, but by what wayes and passages Nature deriueth them as it belongeth to a higher contemplation, so will it be harder to know, and when it is knowne more profitable. The vppward expurgation by the sharp artery or wezon is manifest enough, for when the Chest is dilated the Lungs are blowne vp, & like a sponge sucketh vp the matter wherein they lie soaked as it were in suds, & when the Chest is contracted the Lungs fall downe and so thrust out the purulent matter together with the smoaky excrements of the heart into the sharpe arteries, and they by continuity of passage into the weazon, and so it passeth to the mouth, and by coughing is excluded. But by what waies it goeth to the kidnies and so to the bladder is greatly controuerted. Erasistratus would haue it go by the right ventricle of the heart, & so into the hollow veine, & thence by the emulgent into the kidnies. It is sucked (saith he) first by the rare & spongie flesh of the Lungs, then by the arteriall vein, which is appointed for the nourishment of the Lungs, & thence is deriued into the right ventricle of the heart; out of it into the hollow veine, from thence into the emulgents, thence into the vreters, and so into the bladder. But this opinion of Erasistratus cannot bee true, because nothing passeth out of the arteriall veine into the right ventricle by reason of the membranes which are shut outward, and nothing goeth out of the heart by the hollow vein because of the three-forked membranes which shut inward. Mesues was of opinion, that this expurgation of purulent matter is by the veines, sometimes to the concauous part of the Lungs, & so by the seidge away, sometimes to the gibbous or conuex, and so by the kidnies. Fallopius that oculate Anatomist, thinkes hee found a neerer and more ready way, & for it describeth a small branch which runneth from the *Non-paril*, or *vena sine pari*, along by the ribs, and so pierceth the midriffe, & ioyneth it selfe with the fatty veine called *Adiposa* and the emulgent. This excretion of the pus or matter by the veines I doe not altogether gainsay, yet I thinke it to bee a

By Seidge.

By Apostemation.

Which way is best.

The way of apostemation when good.

By the wombe.

How the matter of the Emulgent is purged

How it commeth vnto the Kidneyes. Erasistratus his opinion.

Confuted.

Mesues opinion.

very

Strange passages which nature findeth.

Answer to the objections

What the passages are.

Objections.

Answer to them.

A mistaking of an apostumation of the heart.

Two Histories, *Hollerius*.

Laurentius

very vnconuoth way because their mouths open not into the chest, neither are the veins stirred with any motion whereby they might sucke so thicke and foeculent a matter, and that it should sweate through their coates is a very difficult matter and hard to be beleued. Some there are which dreame of certaine secret *meatus* or pores for this expurgation, because when men are aliue all passages yea euen substances are open, and the body perspirable yea almost perspicable both within and without.

True it is, that the body is so open; for wee know (as saith *Hippocrates* in his 2. Booke de *Morbis Epidemijs*, & the 55. Aphorism. sect. 7.) That nature maketh way for *Apostumations*, euen through the bones; the dropie water passeth out of the capacity of the abdomen into the guts and sometimes into the wayes of the vrine; the vrine is transcolated through the flesh of the kidneis, the seede through the substance of the testicles, the flegmatick humors of the ioynts sometimes are drawne into the guts, sometimes in a slimy spittle they are auoyded out of the mouth by vnctions of quick-silver. All these things I say wee admit, but why should we seek such insensible passages for this expurgation of purulent matter, when there bee many very patent and easie to bee perceiued? But what are they? Let vs heare *Galen* chalking them out vnto vs, in his 4. chap. and 6. Booke de *locis affectis*. This question (saith he) doth not a little trouble *Erasistratus* followers, who thinke that there is nothing contained in the arteries, but onely spirits; but to vs it is of no difficulty, because we vnderstand that the venall artery of the Lungs can leade so much of the purulent matter of an impostumation as it rescineth into the left ventricle of the heart, to bee thence conueyed into the kidneyes by the great Artery. His meaning therefore is, that the substance of the Lungs doth sucke vp the pus or matter and deliuer it vnto the venall artery, that, vnto the left ventricle of the heart, the heart vnto the trunk of the great artery, and that, vnto the kidneyes and so to the bladder by the vreters. And before *Galen*'s time *Diocles* acknowledged the same way of expurgation.

But let vs heare now the exclamations of some new Writers against *Galen*. How may it bee (say they) that so noysome purulent and mattery a humour can be purged through the left ventricle of the heart, the shop and worke-house of the vitall spirits, and through the arteries and store-houses of the same spirits, without great danger vnto the patient? Shall not the spirits which of their owne nature are most pure, bee infected and tainted in that medley? For if but a malignant vapor or poysonous ayre do breathe from a bone, or any vessell vp vnto the heart, straight we are ouertaken with a fainting or swoounding. Why therefore shall not an vsauory and noysome quitture or pus gotten into the very heart it selfe doe at least so much? But wee know nature to bee so wise and prouident that shee vseth not to moue her excretions but by wayes that are safe and auail: now who will call the heart and the arteries places safe or conduible to leade away such foeculencies? These and such like obiections they make who do not allow of the passages assigned by *Galen*. But they do not remember that it is one thing to bee done critically, and another thing to bee done symptomatically; one thing to be done by force & contention of Nature, another by force and contumacy of the malady; one thing to be done by a faculty, another thing by a disease: and finally, one thing by a strong and vigorous, another thing by a weake and feeble faculty.

If this transfusion of the purulent matter bee criticall and the spirits strong, then is this passage by the heart without any damage to the patient, for nature retaineth and preferueth the spirits and auoydeth onely that which is hurtfull. But if the strength bee feeble, then doth the patient dye in the very expurgation; and if you cut him vp when hee is dead, you shall finde the left ventricle of the heart full of purulent matter; which deceiueth many vnskilfull people, who cry out that his heart was apostumated.

Finally, beside the authority of *Galen*, in his Commentary In *Coacas praeotiones*, and Anatomical demonstration, I will adde for confirmation of this poynt two Histories. The first *Hollerius* reporteth where hee treateth of the heate of the vrine. A certaine woman (saith he) with intolerable torment did make a purulent water; after the fourth month shee dyed and was opened: there were found in her heart two stones, with many small *Apostumations*, the Kidneyes and all the wayes of the vrine being found. Wherefore this purulent matter was purged by the great artery.

Of the other History *Laurentius*, one of our trusty guides in this trauell, is a witnesse. An honest Citizen of *Mompelien* in *France* was sicke or indisposed with a hypochondriacke melancholy for 3. yeares, and the disease grew sharpe, for at length an acute Ague ouertooke him and hee dyed, but a whole month before his death twice in a day lightly hee was troubled with a light swoounding or fainting with some little heate of his vrine, and an incredible

dible desire of making water, but after he had auoyded a thinne, red and stinking vrine, hee came presently againe to himselfe.

After hee was dead and opened, we found the whole cavity almost of his chest filled with that thinne, red and abhominably sented humour, and the like wee found also the left ventricle of his heart to be full of, which, sayth *Laurentius*, when I saw and wondred at, presently the place in *Galen* before quoted came into my minde, and in the presence of some maisters in Chirurgery and many young students in phisicke, I opened, that the cause of his frequent defections and vnconstant strangury was to be referred to the transfusion of the virulent matter through the left ventricle of the heart and the arteries; which my opinion they all applauded; because the humour contayned in the chest and the vrine that hee auoyded in his defections or swounds, were both of a colour, substance and fauour. And thus much to redeeme *Galen* from the vniust imputation layd vpon him by some, otherwise not vnlearned, but in this not so considerate as I thinke they ought to haue beene.

QVEST. VIII.

Of the Temperament, nourishment, Substance and Flesh of the Heart.

Concerning the Temperament of the heart, the Physicians are at great strife among themselves. *Auerrhoes* was of opinion, that the heart of his owne nature was cold, because his greatest part consisteth of such things as are naturally cold, as immovable fibres, foure great vessels which are spermatieall parts & without blood and cold; and that it is hot by accident onely, by reason of the hot blood and spirits contained in it and his perpetuall motion.

This opinion of *Auerrhoes* his followers strengthen with these reasons. First, because the flesh of the heart is thight and solid, & nourished with solide, thicke and cold blood. Secondly, because at the Basis of the heart which is his noblest part, there groweth a great quantity of fat, whose efficient cause (saith *Galen*) is cold. Lastly, because it is the store-house of blood; now blood (saith *Hippocrates* in his Booke de Corde) is naturally cold, for as soone as it is out of the veines it caket. But to the first argument we answered, that the fibres and the vessels are not the chiefe parts of the heart, but the flesh: and therefore *Aristotle* and *Galen* call it a fleshy viscus or bowell. *Hippo.* a muscle. To the second, that the fat groweth not in the ventricles, nor about the flesh of the heart, but onely about his Membrane, which in respect of his flesh is but a cold part: beside, Natures finall cause, that was to keepe the heart from torrifying, ouercame all the rest; which thing in nature is not vnusuall. To the third we answered, that there are two sorts of blood, one venall and another arteriall; the venall indeed is lesse hot, but the arteriall blood is exceeding hot. Now the heart is the shop or worke-house of arteriall not of venall blood.

Wee conclude therefore that the heart is not onely hot, but of all the bowels the hottest, which wee are able to prooue by authorities, reasons, and experience. *Hippocrates de principis* saith, There is much heate in the heart, as being of all members the hottest. *Galen* in the last chapter of his first booke de temperamentis: The blood receiveth his heate from the heart for that of all the bowels is by nature the hottest. The reason is, The heart is the fountaine of heat and of the Nectar of life: it ingendereth the arteriall blood, the venall it attenuateth for the Lungs; heere the vitall spirits the hottest of all others are made. Finally, heere is the hearth and the fire whereby the naturall heate of all the parts is refreshed. Add experience also. For if you put your finger into the heart of a beast suddenly opened, the heat of it will euen burne. So also *Galen* saith in his first booke de semine. Againe, the flesh of the heart is the most solid of all flesh, because it is ingendered of most hot blood, made dense and thicke by the parching power of an exceeding great heate. But some will say that the spirits are hotter then the heart: I answered, it is true that in the spirits there is a greater heat, but in the heart there is more heat, more sharpe and which heateth more, because of the density of his substance; so fire in straw or stubble though it bee a flame burneth but lightly, for you may draw your hand through it without any great offence; but hot glowing yron although it haue not the same degree of heat that the flame hath, yet it burneth more strongly and cannot bee touched without danger. But it may be demanded, if the spirits bee hotter then the heart and are bred in the heart, whence haue they that greater heate? I answered, The heart consisteth of three parts as it were or substances; a spirituall, a moyst and a solid. The spirits

Of the temper-
ament of the
heart.

Auerrhoes that
the heart is
cold. The first
reason.
The second.
The third.

Answer to
the first.

To the second

To the third.

That the heart
is hot.
Authorities.

Reasons.

Experience.

How the spi-
rits are hot-
ter then the
heart by
which they
are made.
Comparison

are

Three sub-
stances of the
heart.

Whether the
heart be moyst
or dry.
An axiome.

Resolution.

How the hart
is nourished.

An axiome.

An argument
from ocular
inspection.

Arguments
for the other
side.

Answered.

A reconcilia-
tion.

Of the sub-
stance of the
heart.
Whether it
be a muscle.

That it is,

That it is not.

Answers of
some to Ga-
len's argu-
ment.

are ingendered of the spirituall and hottest part of the heart, and are hotter indeed then the whole heart, but not hotter then that part that ingendereth the spirits. That this may be, *Galen* giueth an instance in milke: milke in his whole substance is either cold or temperate, but his fatty and buttery part is hotter then the whole body of the milke; so the heart is hot in his whole substance, but the spirituall part of the heart is hotter then the whole heart, and from that part haue the spirits their intense heat: and thus much of the actiue qualities of the heart. Now for the passiue there is as great dissention. *Auicenna de Temperamentis*, and *Galen* in his second Booke *de Temper. Cap. 3.* and 12. and in his 3. Booke *de Aliment. facultatibus* say it is dry, and his flesh hard and solid; now it is a sure rule *That whatsoeuer is hard to feele too in a liuing body, that also is dry.* On the other side *Auerroes* will haue it moyst, because life consisteth in heat and moysture, but the heart is the beginning of life and the shop of moysture. *Galen* in the last Chapter of his first booke *de Temperamentis*, calleth it a Bloody Bowell, therefore moyst, and in the same Chapter, *it is a little lesse dry then the skinne*, therefore moyster then the skinne. I answer, it is true that the heart is moyster to feele too then the skinne. But *Galen* when hee sayeth it is drie, compareth it not to the skinne but to the parts, for so his words are. *The flesh of the heart is so much dryer then the flesh of the spleene or kidneyes, as it is harder.* And so much of the Temperament of the heart.

Concerning his nourishment, *Galen*, in his first Booke *de vsupartium*, and the 7. *de Administr. Anatomicis*, sayeth it is nourished with venall and thicke blood; many of the latter writers say it is nourished with the thinne blood containd in his ventricles. On *Galen's* side, that is on the truths, are these reasons. It is a Catholicke principle, *Euery thing is preserved and refreshed with his like.* The flesh of the heart is hard, thicke and solide, such therefore must bee his nourishment: beside there is a notable veine called *Coronaria* or the Crowne-veine, which compasseth a round the Basis of the heart and sendeth forth branches into all his substance; but Nature vseth not to doe any thing rashly or in vaine, it serueth therefore for his nourishment: beside ocular inspection prooueth it which no reason can conuince. The branches of the coronarie veine are more and more conspicuous on the left side of the heart then on the right, because the thicker part wanteth the more nourishment. But the aduersaries say that the outward part is onely nourished with this veine, the inward with the blood containd in the ventricles: for say they, this veine is too little, to nourish the whole heart being a very hot member and in perpetuall motion; beside the veine looseth it selfe in the superficies of the heart and passeth not into the ventricles. But for the narrownes of the veine I cannot perceiue it is so small as they talke of; and for this motion it is true, yet there are many things that temper it, on the outside it is couered almost with fat, and compassed with a watery humour, and within it hath abundant moysture whereby though it bee not nourished yet is it watered and kept from drying and flaming; as boyling hot water keeps a vessell on the fire from burning. And whereas they say the branches of the coronarie veine passe not into the ventricles, I answer, that neither are the vesselles dispersed into the inner substance of the muscles and the bones. *Hippocrates* sayeth *That flesh draweth from the next vessels.* If you would faine reconcile the new writers to *Galen*, you may say: That haply the inward parts of the heart are nourished with the blood containd in the ventricles but not yet attenuated, for why should the inward parts be nourished with rarified blood and the outward with crasse and thicke; seeing the nature of the inward flesh and outward is all one? and so much of the nourishment of the heart.

Now for the substance and flesh of it, some say it is musculous, but that we haue answered before in the description; briefly thus: *Hippocrates* in his Booke *de Corde* calleth it a strong muscle: againe it is moued by a locall motion and so are none of the other bowels, as the Liver, the Spleene, the Kidneyes, &c. but all muscles are so moued. Moreover, the flesh of the bowels is simple and similar, but the flesh of the heart not so but wouen with threds and fibers like that of the muscles, therefore it is a muscle. *Galen* on the contrary will haue it no muscle, for that muscles haue simple fibres but the heart manifold, the muscles haue but one and that a simple motion, for they bow or stretch forth, lift vp or pull downe; but the heart hath diuers yea contrary motions: and this is a very powerfull argument which yet some seeke to ouerthrow: because say they, there bee many muscles which haue diuers kinds of fibres, & also diuers yea & contrary motions; as the *Pectorall* muscle which hath diuers fibres & moueth the arme not vpward and downward onely but forward also; & the muscle called *Trapezius* which moues the shoulder-blade not only vpward & downward but back-

backward also; and therefore the variety of his fibres and the diuersity of his motions do not exempt him from the number of muscles.

I answer for *Galen*. Those two Muscles aboue named haue indeed diuers motions but not from the same part; but from diuers parts of the muscle; for they haue diuers originals or beginnings. The *Trapezius* ariseth from the back-part or nowle of the head and from the rack-bones of the backe; by the former part it moueth vpward, and downward by the latter. The *pectoralis* also hath diuers beginnings, for it ariseth from the Throate and from the whole breast-bone; wherefore these muscles doe not pull down with the same part where with they lift vp, but the heart is dilated and contracted in the same part; there is not therefore a like reason of their motions. The like may be said of their fibres; for the fibres of those aboue-named muscles though they be of more kinds then one yet are they distinct; the fibres of the heart are wouen together and confounded that no art or industry can pare them. The fibres of the muscles are diuers in their diuers parts; but those of the heart are all in euery small part of the heart.

Moreouer, the taste of the heart and of the muscles is not one saith *Galen* in the 8. Chap. of his 7. Booke de *Administrat. Anatom.* *Anicen* saith the muscles are weary, the heart neuer; yet this seemeth to be no sound reason, because the midriffe which is a very strong muscle mooueth perpetually: but *Anicen* hath another reason for *Galen's* opinion of more force which is this. The heart is no muscle because his motion is not voluntary, for we can neither foreflow nor hasten, neither stay nor stirre vp his motion as we may the motion of the midriffe and of all the other muscles. We conclude therefore with *Galen* that the heart is no muscle, but either an affusion of blood which *Erasistratus* called *parenchyma*; or some peculiar flesh. How *Hippocrates* is to be vnderstood we haue said before, to wit, abusiuely; it is musculous because it is red and fibrous, but not a muscle. But it will be objected it is moued with locall motions, therefore it is a muscle.

I answer, that by the same reason should the womb be a muscle, for we haue shewed how that is moued euen locally sometimes, as when it closeth in conception, or is dilated in the birth: and the guts haue a locall motion called *motus peristalticus*; which no man will say is a voluntary motion or that therefore they are muscles.

To the other argument we say, that the flesh of the hart though it be fibrous yet it is simple, because the fibres are of the same substance with the flesh of it as the fibres of the stomacke, the wombe and the guts; but the fibres of the muscles are particles of nerues and tendons much vnlike their flesh: and this indeed is *Galen's* answer in his 2. Booke de *temperamentis*; yet we affirme that the fibres of the heart are stronger and harder then the rest of his flesh, which maketh it strong and better able to indure his perpetuall labour.

But why is the flesh of the heart more fibrous then that of the Liuer or kidneyes? *Galen* answers, *The fibres of the heart are made for necessary uses of traction retention and expulsion by the right it draweth in the Diastole or dilatation, by the oblique it retaineth, and by the transuerse it expelleth in the Systole or Contraction.*

Answer for
Galen.

It is well
knowne
that

It is well
knowne
that

Answer for
Galen one
weake argu-
ment.

Another
stronger.

The conclusi-
on with *Galen*.

Answer to
Hippocrates
authority.

To the first
reason.

To the second

Why the
flesh of the
heart is fibrous

QVEST. IX.

whether the heart will beare an apostumation, solution of continuity or any grieuous disease.



He last question concerning the heart shalbe whether it will beare any notable disease or no. *Hippocrates* saith (in his booke de morbis.) *The heart is so solid and dense that it is not offended with any humor, and therefore it cannot be tainted with any disease.* *Aristotle*. *The heart can beare no heauy or grieuous disease because it is the originall of life.* *Aphrodisias*. *In the heart can no disease consist, for the patient will dye before the disease appeare.* *Paulus*. *Any disease of the heart bringeth death head-long vpon a man.* *Pliny*. *Onely this of all the bowels is not wearied with diseases, neyther indureth it the grieuous punishments of this life; and if it chance to bee offended present death insueth.* Yet how repugnant this is to experience many Histories doe beare witnesse. *Galen* (in his 2. Booke de *placitis*) reporteth that a sacrificed Beast did walke after his heart was out, and in his seuenth Booke de *Administra. Anatom.* he maketh mention of one *Marullus* the sonne of a maker of Enterludes, who liued after his heart was laide bare euen from the puffle or *pericardium*, and (in his 4. Booke de *locis affectis*) if a man be wounded in the heart, and the wound pierce not

Authorities
that the heart
will not beare
a disease.

Hippocrates
Aristotle
Aphrodisias
Paulus Aeginet
Pliny.

Manifold Hi-
storie pro-
ouing the con-
trary.

into the ventricles but stay in the flesh, hee may liue a day and a night. *Beneuenius* writeth that he hath seene many Apostemations in the heart. Wee told you a story euen now out of *Hollerius* of a woman who had two stones and many Apostemations found in her heart.

How these are
to be reconciled.

Galen interpreted

Answers to
the examples.

A strange story
of a Florentine
Ambassador in the
Court of
France.

Matthias Cornax Physitian to the Emperor *Maximilian* saith, that he dissected a Booke-seller, and found his heart more then halfe rotted a way. *Thomas a Veiga* writeth, that there was a red Deere found, in whose heart was sticking an olde peece of an Arrow wherewith hee had beene long before wounded in hunting. But you shall reconcile these together, if you say the heart will beare all afflictions, but not long; or that it is subiect to all kindes of diseases, but will beare none greeuous. For example, the heart will suffer all kindes of distemper, but if any distemper be immoderate or notable the party presently dies, so sayeth *Galen* in his fift Booke *do locis affectis*, Death followes the immoderate distemper of the Heart. When *Galen* saith, in the fift Chapter of his first Booke *De Locis Affectis*, That the heart will beare no Apostemations, he vnderstandeth such an apostemation as comes by the permutation of an inflammation. For the Creature will dy before the inflammation will suppurate or grow to quittance. Say that the Apostemations found by *Beneuenius*, *Hollerius* and *Mathew Cornax* were Flegmaticke; or say, that rare things do not belong to Art; or with *Auerrhoes*, as in Nature so in diseases we oftentimes find Monsters. That a creature can walk and cry when his heart is out I beleue well so long as the spirits last in his body which it receiued from the heart, when they faile he presently dieth.

Andreas Laurentius maketh mention of a strange accident which happened in the Court of France, *Guichardine* a Noble Knight and Ambassador for the Duke of Florence beeing in good health and walking with other Noble-men, and talking not seriously but at randon, presently fell stone dead neuer breathing and his pulse neuer moouing. Many tolde the King, some saide he was dead, some that he was but falne into an Apoplexie or a Falling sicknesse, and that there was hope of his recovery; The King (saith *Laurentius*) commanded me to take care of him; when I came, I found the man starke dead, and auouched that the fault was not in his braine but in his heart. The next day his body was opened, and we found his heart so swelled that it tooke vp almost his Chest; when wee opened the Ventricles, there yssued out three or foure pound of blood, and the orifice of the great Veine was broken, and all the forked Membranes torne, but the Orifice of the great Artery was so dilated that a man might haue thrust in his arme. So that I imagine, that all the Flood-gates being loosened, so great a quantity of blood yssued into the ventricles that there was no roome for the dilatation or contraction, whereupon he fell suddenly dead; yet is it a great wonder how without any outward cause of a stroke, or fall, or vociferation, or anger, so great a vessell should be broken. It may bee he was poisoned, for the Italians they say are wondrous cunning, and in the Contention of Nature that dilaceration hapned.

QUEST. X.

Of the Nature of Respiration, and what are the Causes of it.

A briefe enumeration
of the difficulties
about the motion
of the heart.



And thus much of the proper motion of the Heart, what causes it hath, what manner motion it is, what power or faculty mooueth the Arteries, when and as the heart is mooued; or after and otherwise: How and where the vitall spirits are generated and their immediate matter prepared, what is the temperament of the heart, how it is nourished, what his structure is, and how many the parts of his substance are with their vse and functions: Finally, how able to beare and endure affects and diseases. The resolution of which questions, though they do not properly pertain vnto Anatomy all of them; yet do they so depend one vpon another as that it seemeth necessary that he that would know one should also know all; notwithstanding in our treating of them we haue very often restrained our Discourse and conteyned it within such limits as are not farre distant from Dissection it selfe.

Of Spiration.

Why necessary

It remaineth now, that we should a little stand vpon another motion in our bodies, and the Instrument thereof which Nature hath ordained to be seruiceable to this motion of the heart, and that is Spiration or breathing. For the Heart being exceeding hot and therefore a part of great expence, needed a continuall supply of nourishment for the spirits, and of ventila-

tion for himselfe. For *Hippocrates* saith in his Booke *De Natura pueri*, *Calidum omne frigidum moderato Nutritur & fouetur*: That which is hot is nourished and cherished by that which is moderately colde: which sentence *Galen* in his Booke *de usu Respirationis* thus elegantly expoundeth; Euen as (saith he) a flame shut vp in a strait roome and not ventilated with the aer burnes dimmer and dimmer till it be extinguished, so our naturall heate if it want cold to temper it growes faint and wasted away to vtter confusion. For it is like a flame mooued both wayes vpward downward, inward and outward; vpward and outward, because it is light as being of a fiery and aery nature; downeward and inward in respect of his nourishment; either of these motions if they be hindered, the heate either decayeth or is extinguished; it decayeth for want of nourishment because it cannot be mooued downeward and inward. It is strangled and extinguished when it cannot be mooued vpward and outward and so refrigerated.

Wherefore, the spiration or breathing of colde is very necessary for the preservation of naturall heate; but what shall this colde be? Surely either aer or water: aer is more necessary in perfected and bloody creatures, first because it sooner followeth the distention of the brest and so the dilatation of the Lungs, and filleth all that is dilated to keepe out vacuity; secondly it cooleth sooner, as better distributing his parts into euery secret corner of the heart: finally it is better expired or breathed out then water, though it be not more easily drawne in. Aer then is the best cooler for the heart, and that must be brought vnto it by breathing: now this spiration or breathing is double, insensible and sensible; Insensible spiration *Hippocrates* and *Galen* call properly *σπέρσις*, and the Latins *Perspiration* and *Transpiration*. The other and sensible breathing is called *ἐνσπνοή*, that is, *Respiration*. Transpiration is by the secret pores of the skin, Respiration by the mouth and the nose. Those creatures whose heate is weake and faint do liue onely by Perspiration, so all that are without blood or which we call *Insecta* of certaine diuisions they haue about their necks or bellies; so the infant in the womb transpireth onely but doth not respire, and many women in fits of the Mother (the natural heate of their hearts being dissolved by a poisonous breath arising from putrified seedes) do liue a while in trances only by Transpiration. But those creatures whose heat is neerer to the nature of flame, by transpiration onely cannot be tempered. Wherefore such heate needeth a farther helpe to waste more aer vnto it, and that is done onely by Respiration.

Whether aer or water is fittest to coole the heart.

Transpiration and Respiration.

Fittes of the Mother.

The parts of Respiration.

This Respiration therefore hath two parts, Inspiration and Expiration; Inspiration is the drawing in of the aer, Expiration the breathing it out. Inspiration is like the *Diastole* of the heart, Expiration like the *Systole*.

This Respiration whether it be Naturall or Animal hath troubled the heads of Schollers a great while, and would also now trouble ours if we should muster together all the Reasons which are brought on both sides; yet because the question is worthy the decision wee will breiefely as we can resolue it with your patience. The arguments to prooue it not to be Animall or voluntary are. First because voluntary actions are from election: but men asleepe (when yet there is respiration) haue no election, no will, because sleepe is a rest or cessation of all Animall actions. Hence it is that *Galen* calleth the *Caras* a sleepe disease *Privationem Animalitatis*, a priuation of all the animall Faculties; yet in that disease the Respiration is free: as likewise in the Apoplexie which is a resolution or palsie of the whole body. Now where is no sense remaining, can there then remaine any voluntary motion? yet we see Respiration remaineth.

Whether Naturall or Animall.

Not Animall. The reasons.]

Againe, to be voluntary and perpetuall are contraries; for voluntary actions do all breed wearinesse, but Respiration breeds not wearinesse in the motion, but if the motion be any whit checked or stayed, that stay or checke breeds wearinesse: Finally when the Respiration is vitiated we apply remedies vnto the region of the braine, which is the originall of voluntary motion. On the contrary, the great argument to prooue it to be voluntary is, that we can breath when we will, and when we will we can stay our breath: so as many haue thus voluntarily ended their dayes, I meane by staying their owne breath. *Galen* in his second Booke *de Motu Muscularum* telleth of a Barbarian seruant, who being throughly angred purposed to lay violent hands vpon himselfe, hee threw himselfe therefore vpon the ground, and held his breath a long time remaining vnmoued, at length turning himselfe a little he breathed out his life.

That it is Animall.

Histories.

C. Licinius Mator a Pretorian Citizen of Rome, being accused for oppression by exactions, whilest the Iudges were giuing sentence shut vp his owne mouth, and couering it

with his Handkerchiefe reteyned his breath till hee fell downe dead.

Coma the brother of one *Maximus* a Captaine of Out-lawes, when he was asked concerning the strength and enterprises of the Fugitiues, gathered his strength together, covered his head, and falling vpon his knees held his breath till he dyed euen in the hands of those that guarded him and before the face of the Iudges.

Cato Uticensis, when his sonne had taken away his sword, hee perswaded his Seruants to giue it him againe, saying he would keepe it for his defence, not to murder himselfe with. For sayeth he, *If I list to die, I could easily hold my breath to serue that turne*: Besides, *Hippocrates* sayeth in his third Section of the second Booke *Epidemian*, that the cure of continuall yawning which Physitions call *oscitation*, is long breathing: and *Aristophanes* in *Plato* his *Symposio*, being troubled with a hiccock, intreated *Erismachus* the Physition to tell out his tale for him, *That will I saith he, and in the meane time hold your breath some good while and your hiccock will cease, and then you shall take my turne as I haue taken yours*. Wee may then reteyne our breath when and how long we will and therefore it is a voluntary action. For the instruments whereby we breathe are all Animal, as the *intercostall* muscles, the midriffe which is also a muscle, and the nerues. Finally, if the braine bee offended as in a phrensie, then is the Respiration offended.

We see here two opposite opinions, both which we cannot maintaine vnlesse they will either of them remit somewhat and yeeld a little either to other, and then it will not bee hard to reconcile them after this manner. Some actions are purely and simply Naturall, as Concoction, Nutrition &c. Some partly voluntary, as speech and walking. Some mixt, that is partly Naturall partly Animall, as the auoyding of water and excrements, as *Galen* sayeth in the fourth Chapter of his 6. Booke *de locis affect*; and in the sixt Chapter of his second Booke *de motu musculorum* he likeneth Respiration to these. Respiration therefore is a mixt action, partly Naturall and that in respect of the finall cause and of necessity, partly Animall in respect of the instruments of it, the museles.

Those that are strangled do not breathe because they cannot Animally; the nerves and muscles being intercepted with the rope. *Hysterical* women that are troubled with the *mother* do not breathe, because they cannot naturally: for there is no use of respiration, nor no necessity vrging it although the instruments bee at liberty; and Nature hath here very wisely ordayned that although this action were absolutely necessary and so naturall for the preservation of life; yet there should also be in it some command of the will, because it is often very profitable to stay the breath and often to thrust it out with extraordinary violence.

If wee be to giue very diligent eare to any thing, if to passe through any vsauoury or noysome places, if we fall or be throwne into the water, it is very necessary that we should bee able to conteyne our breath : on the contrary, to blow vp any thing, to winde a horne or found a trumpet, to blow the fire or such like; it is very profitable that we should bee able to breathe with extraordinary violence. Now in a word we will satisfie the arguments on both sides; and to the first in the first place.

They say that men Respire when they sleepe, but in sleepe there is no vse of election or will. I answer there is a double will, as *Scaliger* sayeth, *One from election proper to men and men awake, the other from instinct, and this is in men asleepe and in brute beasts.* The motion of respiration when we sleepe is by instinct, neither are all the Animall faculties idle in sleep, or extinguished in the *Caros*, *Epilepsie* and *Apoplexie*; but in sleepe they are remitted as *Galen* sayeth, not intermitted (for euen the muscles haue a motion which wee call *Tonicum motum*, *A rigid motion*, especially the two sphincter muscles) and in the diseases they are depraued.

The reason why we are not wearied with continuall respiration, is because there is continuall vse and necessity of it, although it cannot be denied that euen respiration being constrained wearieth the creature much.

On the contrary, they that affirme this respiration to bee meerely voluntary, alleadge that we are able to stay it when we will and to moue it when we will; to which I answer: That is properly and absolutely a voluntary action which may bee stayed at our pleasure when it is doing, and againe done when it is stayed; but respiration is no such action: for if the Respiration be altogether stayed, as in those whose histories are aboue mentioned, then is the creatures life extinguished and the respiration cannot againe bee mooued. And for the two other arguments that respiration is by Animall instruments, and that in a phrensie which

which is a disease of the brayne, the respiration is vitiated. I answered, that they proue indeed that in respiration there is somewhat voluntary, but they doe not proue that there is nothing naturall. Wee therefore do determine that Respiration is a mixt action, and to it do concur both principles ioyned together, the Brayn and the Heart, the Animall and the Naturall faculties.

The determination.

To conclude this Chapter and discourse of Respiration: The pulse and respiration wee see are two distinct motions, yet so neare of kinne as men doe not ordinarily obserue the differences betweene them: wee will therefore in a word tell you wherein they differ and wherein they agree.

How the pulse and respiration differ.

They agree in that that they both serue one faculty that is the Vitall; for they were both ordained onely for the heart which is the seate of the vitall faculty. Moreover, they haue both one finall cause a threefold necessity; of nutrition, Contemperation and expurgation: nourishment of the spirits, Contempering of the heat and purging of smoky vapors. Thirdly, they agree in the condition of their motions, for both of them consist of a *Systole* and a *Diastole*, and a double rest betweene them: but in these things they differ. That the pulse is a Naturall motion, continuall not interrupted, and without all power of the will. Respiration is free, and ceaseth some whiles at our pleasure; the efficient cause of the pulse is only Nature, of Respiration Nature and the Soule together; the instruments of the pulse are the heart and the arteries, of Respiration the muscles: the pulse is from the heart, Respiration not from the heart but for the heart. Finally, the heart beateth five times for one motion of Respiration.

Lastly, whether is the pulse or Respiration more necessary or more noble? More noble surely is the pulse, because his instrument the heart is more noble, his effect the vitall spirit is more noble then the ayre; and the end is better then that which serueth for the end: but Respiration was made for the preservation of the pulse: but now for their necessity there needeth a distinction. There is one pulse of the heart and another of the arteries; the pulse of the heart is more necessary for life then Respiration, but the particular pulsation of the arteries is lesse necessary then Respiration; for though the arteries be bound or intercepted the creature dyeth not presently, but if the Respiration be stopped hee is presently extinguished.

Whether is more noble & necessary the pulse or respiration.

QUEST. XI.

Of the Temperament and motion of the Lungs.

Concerning the Temperament of the Lungs, there is question among the Masters of our Art. Some hold them in the active qualities to be cold, others to be hot. Those that would haue them cold giue these reasons for their assertion.

Of what temper the lungs are. That they are cold. Reasons.

First, because their whole frame and structure consisteth of spermatical that is cold parts: these are, the gristly artery, the arteriall veine: and the venall artery.

Secondly, because they are made to refrigerate the heart, wherefore they are called the *Fanne of the heart*.

Thirdly, because they are subiect to colde diseases, as obstructions, shortnes of winde, difficulty of breathing, and knottines called *Tubercula*.

Fourthly, because they abound with flegmaticke and cold humors, which is discerned by that we cough vp.

Lastly, they alleadge an authoritie and a reason out of *Hippocrates*, the authority, for that he sayth, *The Lungs are of their owne nature cold, and are farther cooled by inspiration*. *Hippocrates* ground out of which they draw this argument is where he sayth in his Book de *Alimentis*, *The Lungs do draw a nourishment contrary to their body, where as all other parts draw that which is like to them*. From whence they reason thus. The Lungs draw vnto themselves blood attenuated in the right ventricle of the heart and are therewith nourished. That blood being very hot, their substance (if *Hippocrates* sayd true, who is saide neuer to haue deceiued any man, nor neuer to haue beene deceiued himselfe) must needs bee cold. But these arguments may thus be answered.

Authority.

A reason drawne from Hippocrates.

Answer to the arguments.

To the first, the vessels are not the substance of the Lungs but the flesh; which is made of a hot and frothy blood.

To the second, that they refrigerate and coole the heart not by their own Temperament, but because they draw and containe outward ayre, which is alwaies colder then the heart though it be neuer so soultury hot.

To the 3. that their vessels because they are many and diuersly implicated are subiect to obstructions, but their flesh which is their true substance is subiect to inflammations and hot affects.

Whence the
phlegme com-
meth that wee
cough vp.
How it be-
commeth
white.

To the fourth, that the aboundance of flegme which we cough vp, is not generated by the native temper of the Lungs but falleth continually from the head which is the receptacle of cold excrements into the Lungs; so saith *Hippocrates*, *Many Catarrhes or Rheumes fall into the upper venter*, that is the Chest. The lower part also as the stomacke and the *Hypochondria* do send vp plentiful vapors which the Lungs with this continuall motion do mixe with the foresaid humor and thence cometh the whitenes. And as for *Hippocrates* authority it may bee answered that hee compareth the temper of the Lungs with the temper of the heart, and then indeede they are cold, as also the aer of a hot-house is cold in respect of the heart.

Hippocrates
expounded &
retorted.

In the other place we say that *Hippoc.* speaketh of the aer inspired or breathed in, not of blood; and so that place proueth that the Lungs are hot rather then cold, because they draw aer which is cold and contrary to their body which is hot. But the truth is, that the contrariety he speaketh of in that place is rather a contrariety of motion; as if he should say, other parts draw a nourishment like vnto themselves from an inward store-house which is the Liuer into the very vtmost parts of the body; but contrariwise the Lungs draw the nourishment of the spirits, that is, the aer by the outward parts, that is, the nose and the mouth into the inward, that is, the heart. Although I am not ignorant that *Galen* interpreteth those words otherwise which shall not be necessary to make mention of in this place.

That the lungs
are hot.
3. arguments.

It seemeth therefore that the Lungs are not cold, which yet will better appeare if we can proue them to be hot. Three arguments we will be contented with; one from their substance, another from their nourishment, and a third from their vse. Their substance is fleshy soft and spongy, made as it were of the froth that ariseth of the hot blood in the boyling; therefore not cold. Againe, they are nourished with thin blood heated and attenuated in the right ventricle of the heart, which seemeth to haue beene made especially for the lungs sake. Lastly, their vse is to prepare aer for the generation of the vitall, that is, the hottest spirit; they must therefore be hot. Thus Physitions reason on either side. I will onely heere put a doubt, reseruing the determination to another place.

A notable
doubt put.

The Rheume falleth out of the head, part into the Lungs and part into the stomacke; Nature in both places worketh vpon it. The stomacke boyleth it againe, attenuateth it if it be thick, and of some part of it maketh good blood; the rest it auoydeth into the guts where another vse is made of it; and if the heate of the stomacke be languide and weake so that it cannot sufficiently mitigate it, we then helpe Nature.

Why the
Rheume must
be thickened
before it bee
coughed vp.
Whence dry
coughes come.

The Lungs quite contrary do thicken that part which falleth into them and that necessarily, for else it could neuer be auoyded; for it must be a solid body that the aer must lift vp before it in our coughing, because there is no passage for it downward appointed by Nature, and therefore it is that thinne and subtile Rheume maketh a dry cough because the aer is not able to intercept it, but it trickleth downe the sides of the weazon still prouoking vs to cough, but in vaine because it hath not a compacted body which aer might intercept till by time it be ripened, that is, grow thicke and then it is brought vp; or if of it selfe it do not thicken we thicken it by Art. We may therefore iustly wonder at this contrary worke of Nature; surely coldnesse in the Lungs can not thicken it, it being so neere to the fountaine of heate, nor the ayer which is the moistest of all Elements cannot dry it: besides that, the Lungs are of themselves very moist as we shall prooue by and by. Againe, if heate in the Lungs do thicken it, why should it not thicken it also in the stomacke; but we see that cold stomacks doe onely make thicke and viscid flegme.

A mystery of
Nature.

Truely heereunder lyeth a great mystery worthy of another place to be discussed in, to which therefore we will referre it and proceede to the second qualities of the Lungs, and enquire whether they be moist or dry. It may seeme they are dry, because their passages doe alwayes remaine open and neuer fall together, which is an argument of their hardnes and drynesse. Againe, *Galen* saith (in his 4. Booke *de usu partium*) they are nourished with chollericke blood, but chollericke blood is dry. Lastly, *Hippocrates* saith the Lungs are the seate of drought; for hee appointeth two places of drought, the stomacke and the Lungs.

That the
lungs are dry.
Arguments.

Con-

Concerning which, is that notable edict of *Hippocrates* (in *Epidemics*.) The way to appease and satisfie thirst is to drinke cold water and to breathe in cold aer. These arguments wee will first answer before we determine the contrary,

To the first we answer, that if the openness of their passages argue their driness, then should the braine also be dry whose ventricles are alwayes open and do not fall together in the strongest concussions or motions of the head, as in sneezing and fits of the *Epilepsie* or falling sicknesse. As therefore the braine is harder in the ends of the ventricles thereof (in which respect Anatomists call that part the Callous body as we shall heare heereafter): So the Lung where it compasseth the vessell is somewhat harder: or say rather, that the stiffness and hardness of the branches of the Sharpe and Rough Artery do hold it out and keep the passages in a kinde of distention.

To the second we answer, that *Galen* by bilious or Cholericke blood meaneth thin and attenuated blood laboured in the right ventricle of the heart, which no man will say is drie but rather abundantly moist, as being mingled with aer the moistest as we saide of all Elements. To the last we answer, that the Lungs indeede if they be torried are the seate of drought, because they dry vp the moisture of the heart and the parts adioyning; but if they be naturally disposed they are no cause of drought. It remaineth therefore that the Lungs are not dry, and then they must needs be moist; which yet further to prooue we want not arguments beyond all exception. First, because they are soft; for as hardness is a sure note of driness so is softnesse of moisture, but the substance of the Lungs is soft and lax, of which the very touch is a sufficient witness. Besides *Galen*'s authority is plainly for it, where he saith in his 4. Booke de *usu partium*, *The flesh of the Spleene is soft indeed and lax, but nothing to the substance of the Lungs which is the softest, the loofest and the lightest.*

Auicenna interposeth saying, *That the flesh of the Lungs is not soft of his owne nature but by accident or event*, because they ly steeped and drunken as it were in the moisture which falleth from the head, therefore he saith they are *not soft but madid*; which if it were so, then would they be drier in those bodies that haue dry braines, and moreover would in al other bodies become drier, as the moisture which falleth from the head is exhausted and dried vp, both which are contrary to all experience. We therefore conclude that the Lungs are naturally moist, and by so much moister then the liuer by how much they are softer. And thus much of the temperament of the Lungs, now followeth their motion.

Concerning which I find three opinions; one of *Aristotles*, another of *Auerroes*, the third of *Galen* and the Physitians. *Aristotle* in the 6. Chapter of his third Booke *De Part. Animalium* thinketh, that they haue the originall of their motion from the heart on this manner. The heate of the heart being encreased, with a kinde of violence listeth vp the Lungs and then aer entrieth for the auoiding of vacuity and emptinesse that infest enemy of nature; the colder aer setleth the boiling of the heate, as we see cold water beeing powred to boyling water setleth it; as therefore in the diffusion of the heate the Lungs are dilated, so the heat residing or setling they are contracted and the aer expressed or driuen out. *Auerroes* ioyneth so far with *Aristotle* that he thinketh the heate to be the author of Respiration, but hee saith that the Lungs follow not the motion of the Chest, but are mooued by a proper and peculiar power of their owne, because else there should be a violent motion which should be perpetuall, that which is vtterly against the rules of nature. True it is (saith he) that there is a wonderfull consent betweene the Chest and the Lungs, which is the cause that one of them cannot mooue or rest but when the other mooueth or resteth, yet neither of them is cause or originall of the others motions. The third opinion is of *Galen* and the Physitians to which also wee encline, who thinke the Lungs are not mooued by an inbred or proper power of their owne, for where are their Fibres and the strength of Filaments or strings for that purpose? Neither by the faculty of Pulsation which ariseth from the heart by which the arteries are mooued, and that because the motion of the Lungs sometimes doeth intermit, sometimes is quicker and slower as we list: neither by the animall faculty because there be no Muscles: but we conceiue that the Lungs are mooued by an accidentary motion, as following the motion of the Chest to auoid vacuity. For when the Chest is distended the Lungs are filled with aer and enlarged, and when that is contracted they are emptied and fall, *Galen* establisheth this his opinion with this reason, because there is no disposition of the body found wherein the Lungs are mooued when the Chest remaineth immouable: which thing Experience also confirmeth. For if the Chest be opened so as the aer may get in by the wound, the Lungs become immouable, because the aer being gotten

Answered.

Galen expounded.

Arguments to prouethe lungs moyft.

Auicenna conceite.

Confuted.

The determination. 3. opinions. *Aristotle*.*Auerroes*.*Galen*. as hee
The Lungs
not mooued by
any proper
power of their
owne.
Not by the faculty of Pulsation.
Not by the Animall faculty.
But by accident or Consequence.
Galen's reason.

Answer to
Auerboes.

Why the lungs
are neuer
weary.

into the void and empty space taketh away the necessity of the motion of the Lungs which is to auoid vacuity as we haue saide: but if the Chest be sound, it is of necessity that it beeing distended the Lungs also should bee dilated for auoyding of that vacuity. And whereas *Auerboes* objecteth that there is no violent motion perpetuall, and yet the motion of the lungs should be violent if it should follow the motion of the Chest. I answer, that the inference is very absurd, for euery motion is not violent which is mooued after anothers motion, for by that reason the bones also should bee mooued with a violent motion. But why are not the Lungs wearied with their perpetuall motion? I answer, because they are almost insensible.

QUEST. XII.

what kinde of motion the Cough is, and whether any part of the
drinke fall into the Lungs.

What parts
are causes of
coughing.

THat the Cough proceedeth from the affection of almost all the parts of the Chest, as the *Pleura*, the *Mediastinum*, the Lungs with their vessels, the midriffe, and sometimes of the *Intercostall* muscles also, it is more then manifest; For in both the kindes of *Pleurisies*, the true and the bastard, the *Peripneumonia* or inflammation of the Lungs; the *Asthma* or difficulty of breathing, the vicer of the Lungs called *Phoe*, the Drop-sie wherein the Midriffe is pressed vpward: in all these I say the Patient is troubled with a continuall Cough. But now to what faculty we should referre this coughing that is a great controuersie. It may be thought it is Animall and voluntary, because the Cough is nothing else but a strong efflation or breathing forth. Now this efflation is done by the helpe of all the muscles which contract the Chest.

That the cough
is from the A-
nimall faculty.

Galen also in his second Booke *de causis symptomatum* speaking of sneezing coughing and vomiting, concludeth that vomiting is a symptome of the naturall faculty, and coughing of the Animall. Others there bee which thinke it to bee an action of the naturall faculty, because it is a concussive motion and is done by the endeouour of Nature, to exclude that which is offensive vnto her; now all Concussive motions are Naturall. For all the parts of the body of their owne naturall constitution haue euery one their owne *Concussions* when they are shaken for the auoyding of any thing which offends them: such is the concussion of the braine in sternutation or sneezing; of the stomacke in the hiccock, of the bladder in auoyding the stone, of the whole habite of the body and the fleshy membrane in a rigor or shaking fit, and finally of the Chest in coughing. Moreouer sometimes we cough against our will, neither can we alwaies when we will forbear it. Both these opinions may be reconciled, if (as we saide earst in respiration so here in coughing) that it is a mixt action of an Animall and a Naturall.

That it is from
the naturall
faculty.

The reconcil-
iation of these
two opinions.

The motion is Animall because it is done by the helpe of muscles, but the cause moouing the motion is Naturall; for a cough is not raised without the endeouor of the expelling faculty. But another question may be asked here, whether the cough be a disease or an ordinary worke of Nature? *Galen* in his second Booke *de symptomatum causis*, and in his fift *de locis affectis* seemeth to determine diuersly; sometimes that it is a worke of Nature: and sometimes againe as in his Booke of *Trembling and Palpitation*, that it is against Nature: but we may well reconcile *Galen* with himselfe if we say, that in respect of the faculty whereby we cough it is a Naturall affection; for the beginning of the motion is from Nature, that is from the expelling faculty; but in respect of the cause which mooueth the faculty as the rheume, the bearing vp of the midriffe or such like, it is against Nature and a very disease; but ouer this cause the Naturall faculty hath a kind of power or command which it sheweth in laboring thus to auoide it.

Whether to
cough be a
disease or no.

Galen reconcil-
ed to himselfe

Whether the
drinke go into
the lungs.

To conclude both this Chapter and all our discourse of the vitall parts, it is a question whether the drinke we drinke goe into the Lungs or no. *Hippocrates* sayeth in his Booke *de corde* some part of it goeth that way, because if you giue a Swine a drinke coloured with vermilion or any such like thing and presently cut the throat, you shall perceiue the weazon colored with the drinke, which is a certaine argument and demonstratiue; also in the same place he thinketh that the water which is found in the *heart purse* is a portion of our drinke: againe Physitians in the fretting or exulceration of the weazon, and diseases of the Chest do

appoynt

appoynt the Patient to ly long vpon his backe and leasurely to licke downe their medicines, that so some of them may fall downe into the Lungs.

Another demonstration may be that the arteries haue more whey or vrine in them then the veines; whence should this whey come? but that a part of the drinke and more liquid nourishment doth slippe downe by the weazon into the Lungs and so into the arteries, and from them by the emulgent arteries into the kidneyes to be auoided by the bladder: for I see no reason why the emulgent arteries should haue beene made so large, vnlesse it were for the expulsion of this excrement. *Aristotle* amongst all the Philosophers is against this. *Hippocrates* in his fourth Booke *de morbis* laboureth might and maine against it, yeelding diuers reasons why it cannot be: but we must vnderstand that *Hippocrates* laboureth to proue that all the drinke goeth not into the Lungs, he confesseth that some slipperh by. And thus *Galen* in his eight Booke *de placitis Hippocratis & Platonis* reconcileth *Hippocra.* to himselfe; namely, that some of the drinke falleth insensibly downe along the weazon, the rest passeth ouer the *Epiglotis* into the stomack: but if neuer so little a crum of solid meate get into the weazon, it bringeth danger of suffocation. So *Anacreon* the Poet was suffocated with a Grape-stone. And *Fabius* the Senator is said to haue beene strangled with a haire which got into his weazon in supping of a draught of Milke. *Alexander Benedictus* writeth that a mother at *Brussels* thrust a pill downe her childe's throate with her finger, vpon which it presently dyed.

Why the emulgent arteries are so large.

Exempl of such as haue beene choked with crums or such like.

And thus much shall bee sufficient to haue beene saide concerning the vitall parts belonging to the middle Region called the Chest, with all the Controuersies and subtleties of Nature thereto appertaining. It followeth now that we should ascend vnto the Throne of the soule, the Tower of the body, which is the Head.

Conclusion of the discourse of the vitall parts.

The end of the Sixt Booke and the Controuersies thereunto belonging.





Of the Third and vpper-most Venter called
the Head, wherein are described the
Animall Organes.

THE SEVENTH BOOKE.

The Præface.

Wherein is contained the summe of the first Eight Bookes.



As a Traueller that desireth to make profit of his paine, when hee hath passed one Citie, before hee enter into another will recount with himselfe his principall obseruations, especially when the recognition of the former may stand him in steade for his better vnderstanding in that to which hee bendeth his course: so I thinke it not amisse hauing passed through so great variety of parts in the body of Man, before I enter into the Third, to call vnto your remembrance (not all the particulars before rehearsed, for that would be irkesome to vs both Gentle Reader) but the Principall, as well to refresh thy memory, as also to make a more easie passage vnto that which followeth.

Man who is the subiect of our whole Discourse, consisteth of a Soule and a Body. The Soule is the Lady and Mistresse, the Soueraigne and Commander. The Body is a most perfect Organ or Instrument of the reasonable Soule, consisting as *Hippocra.* well saith (though obscurely) of Fire and Water.

Why the body
is made of many
organs.

For the Soule, albeit when shee is free from the prison of the Body can see without an Eye, heare without an Eare, and by her owne simple acte discourse without the help of spirits; yet so long as she is immured within these wals of clay she cannot contemplate the Ideas of Externall things without an Externall medium; and therefore Nature (by which I vnderstand the wisdom of the eternall Creator) framed the body of many Organically parts whereby and wherein the Soule might exercise her Diuine administrations, produce and exhibit the powers and efficacies of her manifold Faculties. For the Body indeed is but a dead trunke till the Soule arriue into it, and quickneth it vnto the performance of perfect actions of life.

But because the Soule is of all Formes the most excellent as being created immediately partaker of immortality, Nature in emulation of the diuine *Numen* hath striven to make her habitation also immortall, which although the destiny of the matter did gaine say, yet shee hath brought to so admirable a perfection that it is worthily called *θαύμα θαυμάσιον*; the wonder of Wonders, the Miracle of Nature, and a Little world.

Why the spirit
was created.

Whereas therefore there was no proportion or correspondencie betweene mortality and immortality, betweene the Soule and the Body; Nature with wonderfull skil, out of the principall part of the seede did extract and separate a spirit which lay lurking in the power of the Matter, a spirit I say of a Middle nature betweene Heauen and Earth, by whose mediation as by a strong band the diuinity of the soule might be married to the humanitie of the body. This instrument of Nature we call Fire, which moueth and illustrateth the whole

whole packe of the members, and moderateth all and singular actions of life, of which also it is the next and most immediate cause or instrument.

But because the nature of Fire is such that it hath in it much forme and but a little matter, neither can diffuse the beames of his light vnlesse it be receiued into some substance wherein his power may be vnited; therefore it was necessary there should be another Principle not so subtile, wherein this aetheriall body might expatiate & disport it selfe according to the diuersity of his functions and that without danger of expence. Such a Principle is the mutual confluence of the seeds of both parēts, out of whose slimy matter the *Plastical* or formative faculty of the womb stirred vp by the vigor of heate diduceth and distinguisheth the confounded power of the parts into their proper actions, not without a discerning Iudgement and naturall kinde of discourse. This masse of seede irrigated with the power of the whole body according to *Hippocrates* I call *Water*; not onely because this Element doth delineate nourish and make fruitfull, but also because the future siccity and hardnesse of the spermatie parts stood in neede of a moist and viscid matter whereby those things which otherwise could hardly be sammed together might receiue their conglutination, that so of many dissimilar particles, one continued frame might arise.

The second principle.

This frame thus coagmentated and distinguished for the seruice of the soule, we haue in the beginning of this worke compared to the whole world or vniuerse, and that not without good ground. For as of the world there are three parts, the Sublunary which is the basest, the Cœlestiall wherein there are many glorious bodies, and the highest Heauen which is the proper seate of the Diety. So in the body of man there are three Regions. The lower Belly which was framed for the nourishment of the *Indiuidium* and propagation of mankinde. The middle Region of the Chest, wherein the Heart of man the sunne of this *Microcosme* perpetually moueth and poureth out of his bosome as out of a springing fountaine the diuine Nectar of life into the whole body; and the vpper Region or the Head wherein the soule hath her Residence of estate, guarded by the Sences and assisted by the Intellectual faculties, at whose disposition all the inferior parts are employed.

How the body is like the world.

In the lower Region Nature hath placed two parts more excellent then the rest, whereof one endeouoreth and attendeth the conseruation of the *Indiuidium*, the other of the Species or kinde. The first is the Liuer which some haue said is the first of all the bowels, both in respect of his originall and of his nature. It is seated in the right *Hypochondrium* vnder the midriffe. The figure of it (if you except his fissure) is continuall, but vnderneath vnequall and hollow, aboue smooth and gibbous. In a man this bowell is proportionably greater then in any other creature, and greatest of all in such as are giuen to their bellies. The proper *parenchyma* or flesh of this Liuer, which is most like to congealed and clodded blood, by a proper and inbred power giueth the forme, temper and colour of blood to the Chylus conected in the stomacke, deriued into the guts, prepared in the meseraicke veines and branches of the gate-veine, by which also it is transported to the hollow part of the Liuer, there as we saide wrought and perfected, and so conueyed by the same rootes of the gate-veine, and thence exonerated into that which is called the *Cava* or hollow-veine, by whose trunks and boughes it floweth into the whole body. The temperament of this Liuer is hot and moist; for the moderation of which heate and conseruation of the spirits therein contained it receiueth certaine small Arteries which attaine but onely vnto the cavity thereof. It is inuested round with a thinne coate wherein two small Nerves belonging to the sixth coniugation of the braine are diuersly dispersed.

The lower Region.

The Liuer.

We say moreover; that this same Liuer is the shop or work-house of the venall blood and the originall of the veines; in whose thrummed rootes the more aery portion of the Aliment is conuerted by the in-bred and naturall faculty of the Liuer into a vaporous blood, which becommeth a naturall, thicke and cloudy spirit, the first of all the rest and their proper nourishment: which spirit is the vehicle of the Naturall faculty, and serueth beside to helpe to transport the thicker part of the blood through the veines into the whole bodie; where it needeth but a little ayer and therefore is refreshed and preserued only by Transpiration made by Anastomoses or inoculations of the Arteries with the veines in their extremities or determinations. This Naturall faculty (wee before mentioned) is diuided into three faculties, the Generatiue, the Alteratiue and the Increasing faculty. Of the Generatiue we shall speake by and by. The action of the Alteratiue faculty is Nutrition which hath many handmaidens attending her, Attraction, Expulsion, Retention, and Concoction. The action of the Increasing Faculty we call Accretion, that is, when the whole body

The Naturall faculty.

encrea-

encreaseth in all his dimensions. Finally, we say that concupiscence as it is a distinct Faculty from Reason and Rage, ruleth and beareth sway in the Liver as in her proper Tribunall, and is distinguished into *Libidinem & Cupediam, Lust and Longing*.

The parts of
Generation.

But because in all her workes Nature ever intendeth immortality, which by reason of the importune quarell and contention of contraries she could not attaine in the *individuum* or particular, she devised a cunning stratageme to delude the necessity of Destiny, and by an appetite vnto the propagation of the kinde, hath sowed the seedes of eternity in the nature of Man, For the accomplishing of which propagation shee hath ordained conuenient instruments in both sexes, which are for the most part alike, but that the instruments of the Male are outward, those of the Female for want of Naturall heate to driue them forth are deteyned within. The Chiefe of these are the Testicles, two Glandulous bodies of an ouall Figure which in men hang out of the *Abdomen* and are inuested with foure Coats, whereof two are common, the *scrotum* or Cod a thin and rugous skinne, and the *Dartos* which hath his originall from the fleshy Panicle. The other two are Proper, the former is called *Erytroides*, and the latter *Epididymis*. The temperament of these Testicles is hot and moyst, and they haue a very great consent with the vpper parts especially with the Middle Region, as also hath the wombe. The manner of the Operation of the Testicles is thus.

The Testicles.

The matter of the seede, together with the spirits carrying in them the forme and impression or character of all the particular parts and their formative Faculty, falleth from the whole body and is receiued by the Spermatice Vessels, in whose Labyrinths by an irradiation from the Testicles it is whitened. After it is so prepared it is conueighed to the *Epididymis* thorough whose insensible passages it sweateth into the spongy and friable substance of the Testicles themselves, where hauing attained the forme and perfection of seede it is deliuered ouer by the ejaculatory or rather the Leading-vessels to the *Parastata*, and from them transcolated to the *Prostata*, which reserue the seede being now turgid and full of spirits for the necessary vses of Nature. Hence it followeth that the power which is called *seede-making*, that is, the *seede-making* Faculty, or the Faculty of generation, is from the Testicles immediately, by which Faculty, the parts being stirred vp do poure out of themselves the matter of the seede when *Venus* doth so require. This Faculty is the author in men of Virility and in women of Muliebrity and breedeth in all creatures that *per se* by which the heate being blowne vp is the cause *τῆς ἐκβολῆς*, so that the blood being heated and attenuated distendeth the Veines, and the body or bulke of that part groweth turgid and impatient of his place, which the Grecians call *ἐκβολή*. And thus much of the Lower Region.

The Middle
Region.

In the Middle Region there are many parts of great worth, but the excellencie of the Heart dimmeth the light of the rest, which are all to it but seruants and attendants.

The Heart.

The heart therefore is called *καρδία ἀπὸ τῆς καρδίας*, which signifies *to beate* because it is perpetually moued from the ingate to the outgate of life.

This is a Pyramidal Bowell whose *Basis* is in the middle of the Chest, the *muero* or point reacheth toward the left side. The magnitude but smal that the motion might be more free and nimble, the flesh very fast and exceeding hot intertexted or woven with all three kinds of Fibres but those made of his owne flesh, and nourished with blood which it receiueh from two branches of the Coronary Veine.

On the out-side it hath a great quantity of fat and swimmeth in a waterish Lye without acrimonie, which is conteyned in the *Pericardium* wherewith as with a purse the Heart is encompassed.

On the inside it is distinguished by an intermediate *partition* into two Ventracles. The right is lesse noble then the left and framed most what for the vse of the Lungs. It receiueh a great quantity of blood from the yawning mouth of the Hollow-veine, and after it is prepared, returneth the same blood againe through the Arteriall veine into all the corners of the Lungs. This right ventricle hath annexed to it the greater eare, and sixe Valves are inserted into the Orifices of his vessels. The left Ventricle which is also the most noble hath a thicker wall then the right, because it is the shop of thin blood and vitall spirits. Out of this Ventricle do two vessels issue, the first called the Venall artery which receyueth the ayer prepared by the Lungs, and for retribution returneth vnto them vitall blood and spirits; at which artery the left deafe eare is situated, and in whose orifice there stande two Valves bending from without inward. The other vessell of the left Ventricle is the *Aorta*

or great Artery which distributeth vnto the whole body vitall blood and spirits, or (according as the opinion of some is) it draweth the better part of the Chylus by the Meseraicke Arteries into the bosome of the left ventricle for the generation of Arteriall blood, and at his mouth do grow three Valves opening inward. Wee say further that the Heart is the habitation of the vitall Facultie, which by the helpe of Pulsation and Respiration begetteth Vitall spirits of Ayer and Blood mixed in the left Ventricle. And this Facultie although it bee Virall yet is it not the *Life* it selfe, and differeth from the Facultie of Pulsation both in the functions and in the extent and latitude of the subiect. The Facultie of Pulsation is Naturall to the heart, as proceeding and depending vpon the vitall facultie. For it is not moued *αποαισθητικῶς* or voluntarily as is the Animall Facultie, but onely obeyeth the command of the necessitie of Nature.

The Vitall facultie.

From the foresaid facultie of Pulsation do proceede two motions, the *Diastole* and the *Systole*, betweene which there is a double Rest. These motions in the Heart and Arteries are the same and at the same time, but so, that the cause of the motion is supplied from the Heart vnto the Arteries as from a principle both moued and mouing.

Finally, to come vnto that which we are now in hand withall. In the vpper region we meete with the braine compassed with the strong bartlements of the scull, adorned with the Face as with a beautifull Frontispice, wherein the Soule inhabiteth, not onely in essence and power as it is in the rest of the body, but in her magnificence and throne of state. This Braine is the most noble part of the whole body and framed with such curiosity, so many Labyrinths and Meanders are therein, that euen a good wit may easily bee at losse when it is trained away with so diuers sents in an argument so boundless and vaste. Notwithstanding we will as briefly and succinctly as we can giue you a viewe of the Fabricke and Nature thereof, referring the Reader for better satisfaction to be ensuing discourse, wherein we hope to giue euen him that is curious some contentment.

The vpper Region.

The substance therefore of the Braine is medullous or marrowy, but of a proper marrow not like that of other parts; framed out of the purest part of the seed and the spirits. It is mouable and that with a naturall motion which is double, one proper to it self, another comming from without. It is full of sence, but that sence is operative or actiue not passiue. For the behoofe of this Braine was the head framed, nor the head alone but also the whole body, it selfe being ordained for the generation of animal spirits and for the exhibiting of the functions of the inward senses and the principall faculties: in this braine we are to consider first his parts then his faculties.

The Braine.

The Braine therefore occupieth the whole cavity of the skull, and by the *Dura mater* or hard Membrane is diuided into a fore-part and a backe-part. The fore-part which by reason of the magnitude retaineth the name of the whole and is properly called the Braine, is againe subdiuided by a body or duplicated membrane resembling a mowers sythe, into a right side and a left, both which sides are againe continued by the interposition or mediation of a callous body. This callous body descending a litle downward appeareth to be excauated or hollowd into two large ventricles much resembling the forme of a mans care, through which cauities a thrumbe of crisped vessels called *Plexus choroides* doth run, wherein the animall spirits receiue their preparation; and out of these Ventricles doe yssue two swelling Pappes which are commonly called the Organes of smelling and do determine at the spongy bone about the top of the nose.

These two Ventricles are disseuered by a fine and thin body called *Speculum lucidum*, or the *Bright Glasse*, vnto which adioyneth the Arch of the Braine called *Corpus Cameratum*, which is supported by three Columnes which like *Atlas* do sustaine the weight of the Braine, so that the third ventricle which lieth vnder them is not obliterated. This middle ventricle which is a common cavity of the two vpper, occupieth the very center of the braine and runneth out with a double passage. The first descendeth to the Basis of the Braine where the originall of the Nerves is most manifest, and the extremity thereof endeth in a portion of the *Pia mater* or thin membrane very like vnto a Tunnell, through which Tunnell the flegmaticke excrement of the Braine is transcolated into the pituitary glandule thereunder disposed; and so thorough the holes of the wedge-bone distilleth into the Palate of the mouth.

The other passage of the third ventricle which is larger then the former is directed vnto the fourth ventricle where the Glandule or kernell called *corāptor* is seated, at each side of which do adioyne the *Buttocks* of the Braine, and vnder them the *Testicles* appeare, which seuer the passage of the Animall spirit out of this into the fourth Ventricle. Finally, the fourth ventricle

The Animall
Faculty.

succeedeth, which is the least and most solid of all the rest, and wherein say some, the Animall spirit receiveth his utmost perfection, and therefore it is made in the Cerebellum, that is, the backward or After-braine, which for this very reason was framed of a harder consistence then the former. And so much of the parts of the braine. Now for the faculties; we determine that the Braine is the Pallace of the Rationall Soule, which Soule vsing for her instrument the temper and conformation of the Braine, according to the diversity of her functions bringeth forth mixt actions by the mediation of the Animall spirit. These very actions produced according to the variety of the temperament and *medium*, into diuers acts of Ratiocination, Imagination and Memory (as the Soule is best pleased to worke) we call faculties; which are seated and established together and promiscuously in one and the same place.

Again; we say that this Braine as it is the beginning of the inward, so is it also of the outward senses, from which each of them receiuing their proper vessels or passages together with their Faculty do suffer the incursions of Species or Images resorting vnto them according to the diversity of the Organe. The eye receiveth the visible formes, the eare the audible, the nose such as cast an odour from them; and so of the rest. All these individuall formes received by the senses, are by them resigned vp in token of fealty to the Common sense or priuy-chamber of the Soule from whence they receyued their faculties; and then out of those formes the Soule gathering phantasmes or notions doth eyther lay them vp in the memory, or work vpon them by discourse of Reason. Finally, we attribute to the Braine the faculties of sense or motion, which faculties together with the Animall spirit differing in forme and kinde from the vitall, and prepared concocted and perfected in his ventricles and substance, he doth continually and without intermission transmitt through the same nerues into the whole body to supply the expence of the foresaide spirits, which is made either by action or by passion.

And thus haue wee runne through not onely the two lower Regions to refresh our memories, but also the vpper, wherein the Reader may haue such a taste of that which followeth, as may haply make him sauiour it the better when he commeth thereto. And so wee proceede to our businesse.

CHAP. I.

Of the Names, Scituation, Forme and Parts of the Head.



AVING hitherto as exactly as we could and with great leasure made our progresse through the two lower Regions Naturall and Vitall: It is now time wee should ascend into the third venter, the seate and very residence of the Soule, the sacred Pallace or Tower of Pallas, and there suruay her Royall Court, her Guard of outward Senices, her Councillors of State and all their equipage.

The Names of
the head.

This Region therefore is by the *Grecians* called κεφαλή, κέριον and κέριον. *Appians* Interpreter holds it was called κεφαλή, of a word which signifieth to grow dry, because being of a bony substance it must needs be dry. *Apollidorus* derives it from the word καλύπτω to hide or couer, because it is the courring of the braine. Others because there κείται τὰ φῶς the lights are placed. Others ἀπὸ τῆς κενοῦρας, from the Cavity or hollownes of it. The *Latins* call it *Caput*, because from hence the senses do *Capere initium* take their beginning.

A strict signi-
fication
Celsus descrip-
tion of the
Head.

There is a double acception of the word *Caput* among Physitions, one strickt and presse, another large and ample. In the strickt signification it is vsed by *Celsus* our of *Hippocrates* Booke of the wounds of the head and thus described. The Head is the Mansion and skonce of the Braine, whose skull is made of two tables, betweene which is a marrowey substance called *Diplois*, inuironed with Caruncles and small veines, ouer which is spread the Membrane called *Pericranium*; which Membrane is couered againe with the hairy scalpe; but vnder the skull lyeth the Membrane called *Dura mater*. And in this signification the ancients called it ἀρτήρ, the Vessell of the braine; wee also in our common speech call it the

Skonce.

Skonce.

The large sig-
nification.

But in the large and ample signification, vnder the name of the head we vnderstand all that is circumscribed within the first racke-bone of the Necke and the top of the Crowne. Wee wil intreate of it in this large signification: wherein therefore we are to consider of the forme, the Scituation, the Magnitude, the Frame and Structure, the Motion and the Particular parts thereof.

First

First, therefore the head was made round and that for diuers reasons. Inprimis: That it might be of greater receipt & capacity, because it was to receiue the vast & huge bulk of the braines. For the braines of a man are foure times as big as of an Oxe: now of all figures the round figure is of most capacity, witnesse the world it selfe.

The forme.

Secondly, the head was made round *ad suauitatem*, that it might be lesse subiect to outward iniuries nor so easily wounded. For this figure as it is most capacious, so is it the strongest, because it hath no asperity whereupon a blow might fasten, but is euery where a like smooth, hauing no point whence the dissolution of it should commence.

Why round.

Thirdly, the head is round for his better motion, that it might bee speedily and easily turned to euery side. The *Platonists* thinke that the head was therefore made round, because it is the seate and habitation of the Soule. For the Soule is infused into vs out of Heauen which is round. Adde heereto that the most Noble member deserued the most Noble figure.

Notwithstanding though the figure of the head bee round, yet is it not exquisitely and to a haire globous, but somewhat long, swelling out with two tops like promontories, which therefore they call heads of land; it is also pressed on the sides. Long it was to containe the braine and the Cerebellum; swelling out before because of the mammillary processes which are the Organes of smelling, and behind to admit the originall of the marrow of the backe.

Why come referred.

It is pressed on the sides, but more forward: first because the proceffe of the backe called *Dorsalis*, is much thicker then that ordained for the outlet of the Nerves of the face. Secondly, because in the forepart there was to be a bosome or hollownesse, into which the aer was plentifully to passe, that is, the mouth. Thirdly, that the eyes rowling on eyther side, might not haue their prospect hindred by the bones of the Temples, which would haue bene if the skul in that place had bene more embowed. Lastly, that the head might stand equally ballanced; for seeing the forepart hath his waight increased by the lawes, the head would haue waighed too much forward if the back-part had not bene more embowed and runne out as it were into a knowle, which therefore with little alteration in the word and lesse in the sence we call the *Nowle* of the head.

More on the forepart.

But descanting thus about the figure of the head, it must bee vnderstood that wee meane a head Naturally disposed; for otherwise of vnnaturall formes, some are perfectly round, others do rise vp in the toppe like a ridge almost of a house, bearing little bredth in the Crowne. The round head they call in Greeke *κρανιον* because it hath no *προβολη* or ietty eyther in the fore-head or in the nowle. The sharpe or turbinated head is called *ραξος* or as *Athenaus* hath it *ραξος*, because to them that behold it, it seemeth somewhat sharpe like a Sugar-loafe. Such a Head had *Thersites* in *Homer* much like those moulded Cups among the Græcians which were called *ραξιδες*. *Eustathius* rather thinketh it is called *ραξος* quasi *ραξος* of *ραξ* which signifies flame, because flame endeth in a sharpe Cone or spire. But of the formes a little more heereafter when we will also exhibite the pictures both of the Naturall and of the vnnaturall formes.

Naturall heads.

Vnnaturall.

Thersites in Homer.

The magnitude of the head is diuers in diuers creatures, yet greater in man then in any other, because his braines are of a bigger bulke. A little head is alwayes faulty, because it argueth both the impotency and weakenesse of the forming Faculty, and also the want of spermatie matter. Whence it is that Physiognomers say, that a little head betokeneth a sudden and rash wit, because in such there is want of spirits, which being pent vp in a narrow roome, are heated about measure, and beside haue no space to moue themselves in.

The magnitude. A little head.

A great head, if other things be equall, that is, if there bee an equall proportion of all the bones is alwayes laudable. Whence *Hippocrates* in the sixth Booke of his *Epidemion*, sayth, that wee must esteeme and measure the Nature of the bones according to the magnitude of the Head: not that the bones doe arise from the Head, but because all the bones should proportionably answere to those to which they are articulated or ioyned. For example, The bones of the arme to the shoulder bones, the hippes to the holy-bone, the holy-bone to the racke-bone, the racks to the marrow of the backe, the marrow to the braine, the braine to the skull.

A great head.

Hippocrates expounded.

But *Aristotle* in his Problemes saith that a man is the wisest creature, because hee hath a little and a short Head. Wee must vnderstand that by *Paruity* hee meaneth the thinnesse of the bones and the flesh, not that the inward cavity of the skull is little in respect of other creatures.

Aristotle expounded.

The situation

Galen.

Auerroes.

Why the brain
is set highest.

The Head is situated in the highest place, because say the *Platonists* it behoued that the intelligible Faculty of the Soule, as the Queene and Princeesse of the rest should sit in an elevated Tribunall, that the *Irascible* and *Concupiscible* Faculties as handmaydes should rest at her feet, bee seruiceable vnto her and obey her commands. *Galen* doeth not say in his eight Booke of the *Vse of parts* (though *Auerroes* would father it and fasten it vpon him) that the Head was made for the Eyes; (for it was made onely for the Braine) but he saith indeed that it was lifted vp into the highest place because of the Eyes. For the Eyes being ordained as scout-watches, to looke out for vs Night and Day, it was requisite that their station should bee in the highest place; but because the sight stood in neede of the softest sinew and the shortest, least his soft body if it had beene any thing lengthned might haue beene in danger of breaking: therefore it was necessary that the Braine which is the originall of sinewes should be placed neere the Eyes: neither doth this scite of the braine auayle the Eyes onely, but also all the senses, for the smell better apprehendeth an ascending vapour, and the voice is better heard from above.

The parts of
the head and
their names.The parts of
the scalp.Hippocrates.
Aristotle.

Galen.

Another diu-
sion of the
parts.
Contayning.

Contayned.

The Head is diuided into two parts, the one is hayry the other without hayre: the hayry part is called *τριχωτός*, *Calua* the scalp; that which is without haire is called *πρόσωπον*, *Facies* the Face. The scalpe from the cauity and roundnes of it is called by *Aristotle* in the 1. Booke of his History of creatures and the 7. Section, and by *Pollux* *σκαρίον*. This comprehendeth all the vpper part, backward as farre as the haire groweth, forward to the forehead: it hath three parts. The forepart reacheth from the forehead to the coronal suture or crowny seame and taketh vp almost halfe of the head; it is called *βρέγμα ἀπὸ τοῦ βρέχεν* which signifieth to water, because it is the softest and the moistest, *Sinciput* also of the Latins, as if it were *summu caput* the top of the head, although there be a higher place.

The backpart of the scalp reacheth from the Lambdall suture to the first rack-bone of the necke. *Hippocrates* in his Booke de *vulneribus capitis*, calleth it *ωτίς*. *Aristotle* *πρὸς ἀνὰ τὸ ἰσθμὸς τοῦ νυμφῶδος εἶναι*, because it is fibrous and neruous, for many tendons reach vnto it; beside almost all the nerues arise from about that part, in Latin *Occiput* or *Occipitum* as *Plantus* hath it; we call it the nowle. The middle part of the scalpe betweene these is gibbous or round called in Greeke *κορυφή* of *κρύπτω* to hide as it were *κρυφή*, because that part of the head is especially couered with haire.

Galen in the eleuenth Booke of the *Vse of parts* and the 14. Chapter, calleth it *Aruum pilorum* the Field of haire: the Latins call it *Vertex*, because in that place the haire runne round in a ring as waters doe in a whirle-pool. Finally, the sides of the scalp betwixt the Eyes, the Eares and the Necke are called *κόρυθαί, παρά τὸ κρυτεῖν περὶ τὴν ἀσπίδα*, saith *Aristotle* in his first Booke of his History and the eleuenth Chapter, because the pulse is there very manifest; the Latins call them *Tempora*, because their gray hayres and sunken flesh bewray the age of a man.

Againe, the parts of the scalp are containing and contayned. The containing parts are some of them Common some Proper. The Common, are the *Cuticle* or scarfe skinn, the true skinn bearing a wood or bush of hayre, the Fat and the Flethy pannicle. The Proper containing parts are either externall or internall. The externall are two Membranes, *Pericranium* and *Periostium*, certain muscles and the bones of the head. The proper inward conteyning parts are two mothers called *Meninges*, *dura* and *pia*, which encompass both the skull and the braine.

The parts contayned are the braine and the *Cerebellum* or after-braine, from which ariseth the marrow, which when it is gotten out of the skull is properly called the marrow of the back, or pith of the spine, from which doe arise many nerues as well before it issue out of the skull as after. Of these we will first entreat, and then after of the part without haire or the face in the Booke following.

CHAP. II.

Of the common contayning parts of the Head.

Common
parts.

THe common contayning parts of the head are 5. the haire, the cuticle, the skin, the fat, and the fleshy pannicle, of all which we haue spoken heretofore at large; yet because in euery one of these there is some difference from the same parts in other places of the body we must a little here insist vpon them, and first of the haire.

Albeit

Albeit therefore the haire is generally more or lesse all ouer the body as before is said, yet about all places the head is adorned with the greatest aboumdance of them. The haire of the head are the longest of the whole body, because saith *Aristotle* in his first Booke *de Generatione Animalium* and the third Section, the braine affoordeth toward their nourishment a large supply of humor, or vaporous moysture whether you will, which also is most clammy and glutinous. For the braine is the greatest of all the glandulous bodies. They are also in the head stiffest, because the skinn of the head is the thickest, yet is it rare and full of open pores, so saith *Galen* in his ninth Booke *de vsu partium* and the first Chapter. In the head Nature hath opened conspicuous and visible waies for the vaporous and smoky or sooty excrements, for the head is set vpon the body as a rooffe vpon a warme house, so that vnto it doe arise all the fuliginous and vaporous excrements from the subiected parts. The haire of the head are called in Latine *Capilli*, as it were *Capitis pili*, by *Pollux* and *Eschylus* *κρίνα* to cutte. In men they are called *κρίνα*, *Casaries*, because they are often mowed; in women *κρόμη* of *κρόμη* to dresse with diligence, from whence haply wee haue our word to combe, or rather from the Latin word *Coma*, whose signification is al one with the former. In women they are diuided by a line, which separation the Greeks call *λυσισμα* the Latins *discrimen* and *equamentum*, in English ewecall it the shed of the haire.

The skinn of a man although in comparison of other creatures it is most thinne; yet if you compare the skinn of the head with that of the chest or the lower belly it is very thick as also is the cuticle. And therefore *Columbus* insulteth ouer *Aristotle* for saying that the skinn of the head is very thinne. The place is in the 3. Booke of his history of Creatures, and 11. Section, where he doth not say that the skinn of the head is very thinne, (for in the fifth Booke *de Generatione Animalium* and the 3. Chapter, hee calleth the skinn of the head *παχυτάτος*, that is, very crasse and thicke) but he saith (and that truly) that the skinn of a man in respect of his magnitude is very thin.

Well, the skinn of the head as it is the thickest, so (saith *Galen* in his second Booke *de Temperamentis* and the 5. Chapter) it is so much drier then the skinn of the rest of the body by how much it is harder; yet is it rare saith *Aristotle* in the place next about named, that the sooty excrements might be auoided for the generation of haire as before is said. It hath vessels running in it, Veines from the outward branch of the externall iugulars, which creeping on both sides are vnited in the forehead, and are sometimes opened in grievous paines of the head, and these veines running vnder the drie and hairie skinn carrie blood vnto it for nourishment. Arteries it hath also from the outward branch of the *Carotides* deriued to the rootes of the eares and to the temples especially, which bring Vitall spirits vpward from the heart.

It receiueh also certaine ends of Nerues reflected vpward from the 1. and 2. coniugation of the Neck to giue it sense. I said ends of Nerues, for so saith *Galen* in his 16. Booke *de vsu partium* and the 2. Chapter. The skinn hath not a proper and definite Nerue belonging vnto it as euery Muscle hath his Nerue disseminated in or about his body; but there attaine vnto it certaine Fibres from the subiected parts which connect or knit it to those parts, & also affoord sense vnto it. The sense of this skinn of the head is not fine and exquisite as in the chest or the Lower belly. *Aristotle* in the 3. Booke of his History and the 11. Chapter saith, it hath no sense at all, and rendreth at reason because it cleaueth to the bone without any interposition of Flesh. But *Galen* disproueth this opinion in his 16. Booke of the vse of parts, and the 2. Chapter. It may be *Aristotle* meant the Cuticle and not the true skinn. Or excuse him as *Archangelus* dooth, who saith that he meant it of the true skin, but as it is a similar part distinct from a Nerue, for indeed onely the Nerues haue sense. *Bauhine* and *Laurentius* giue another reason why the skinn of the Head is lesse sensible, because (say they) in the Head the skinn adhereth but to a Musculous or fleshy Membrane, whereas in other parts it cleaueth to a neruous Membrane.

The vse of the skin of the head is to compasse the scull and be a couering vnto it.

There is no Fatte at all (saith *Platerus*) vnder the skinn of the Head, and he giueth his reasons, first because there is no vse of it, for the small vessels vnder the hairy Scalpe are placed in sufficient safety, there needed therefore no Fat at all to secure them. Secondly, because there had beene an abuse of it. For in the Infant the Head is proportionably to the other parts exceeding great, but if it had any Fat about it, it would haue beene a great *Remora* or impediment in the birth. But *Vesalius* in his 7. Booke and the 18. Chapter saith, that a man may easily with his hands diuide the skin with the Fat, and the fleshy Membrane from the Scull. And

Aristotle.

Galen.

Pollux.

Eschylus.

The skinn of the head.

Aristotle redacted.

The Veines.

Arteries.

Nerues. An elegant place in Galen.

Archangelus. Why the skin of the head hath but a dull sense.

The vse.

The fat.

Platerus.

Columbus saith, that beside the *Yard* and the *Codde* there is no part but a man may finde *Fat* in it. The truth is, that in the fore-head there is none at all, for because in the fore-head the skin is moued at our disposition it would haue been a hinderance to his motion, for that in this place the skin is vnited to a Musculous substance, but in and about the *Occipitium* or nowle of the head there is some *Fat* to be found.

The fleshy
membrane.

Falopius.

The fleshy Membrane spread vnder the skin cleaueth close vnto it in the fore-head, because there is no *Fat* to separate them, and there this Membrane is very thick. It also sometimes runneth like a tendon from the Muscles of the fore-head to the Muscles of the nowle and the eares, insomuch that *Falopius* warneth vs to take heed least we mistake if for the *Pericranium*, and the *Pericranium* for the *Periostium*. And thus much for the common inuesting parts of the Head, how they differ from the same parts in other places of the Body.

CHAP. III.

Of the *Pericranium*, *Periostium*, and the Muscles about the Head.

Pericranium.

Falopius.



His originall:

Progresse.

The Membrane which lyeth next vnder the fleshy Pannicle is called *περικράνιον*, because it compasseth the whole scull on the out-side. The Arabians call it, *Almocat* and *Almocatin*. *Laurentius* would haue it called *Periostium*. And *Falopius* in his Institutions and in his Booke *de Ossibus* and the 19. Chapter saith, that this Membrane is common to all the bones about the scull and called *Pericranium*, but by his common name *Periostion*. It is scituated betwixt the fleshy Panicle and the *Periostium*, to both which it is tyed by certaine Fibres. Soft it is and thin, but thight and solid saith *Laurentius*, and of exquisite sense. It ariseth from certaine processes of the *Dura Meninx* like thin Membranes or rather Ligaments (for they haue the vse of Ligaments) passing through the futures or seames of the scull. For euery one of these Ligaments are extended ouer that part of the scull against which they issued, and going on meete one with another and are exactly vnited so that all of them put together make a common Membrane. This Membrane dooth not onely encompassse the scull, but also the temporall Muscles, although the Anatomists commonly take it in that place for the coate of the temporall Muscles or for a Tendon of them, making them to haue two Tendons, one outward, and another inward, whereas indeed saith *Falopius* in his obseruations it is nothing else but a part of the *Pericranium*. Yet doth it not clothe these Muscles so farre as to their insertion, but onely as farre as the Iugall bones and that for their safegarde; and the better it may doe them this good turne because in that place it is thick and hard; it parteth therefore from these Muscles neere vnto the Iugall bone as is said, where betweene the Membrane and the Muscles on either side there is a little what of *Fat* to be found.

His vse.

Platerus.

Periostium.

Falopius.

Baubine.

How the
Bones feele.

The vse of this *Pericranium* is to binde and rowle the scull on the out-side round about as it were with a rowle or swathing band whereby his bones are firmid; it knitteth also the *Dura Meninx* to the scull, and hangeth it so that it cannot fall or presse vpon the Braine. *Platerus* addeth that it tieth vnto it selfe the skin of the head and that very strongly, because there is no flesh nor fat betweene them, and that is the reason that onely the skinne of the head when it is wounded needeth not to be sewed together, because the lippes of it doe not not cannot start farre asunder being held together by this Membrane.

Next vnder this lyeth the *Periostium*, which saith *Vesalius* you may seuer from the *Pericranium* with the point of a knife, although *Falopius* thinke they are both one, and *Laurentius* conceiueth that Anatomists are deceiued by the thicknesse of the *Pericranium*, which heere was necessary because it couereth a noble bone. But *Baubine* whom we will now follow describeth them seuerally. The *Periostium* therefore is a Neruous Membrane and therefore very strong and thin. It cleaueth very strongly to the scull as also it doth to the rest of the bones; the reason is, because the bones being very hard substances would not bee altered or affected with any object, and so want the benefit of the Tactile quality, vnlesse they had benee couered with this Membrane of exquisite sense, by whose assistance now they are not destitute of feeling; whence by the Grecians it is called *περίοστος*, that is, *Circum ossalis* about the bone; for it compasseth all the bones excepting the teeth onely saith *Varolius*, but we may also except the inside of the scull and the articulations or ioynts of the bones; for if it had benee extended ouer the ioynts wee could not haue moued them without paine. Some, saith *Columbus*, being

being ignorant of the
of sense.
The Muscles ab
thers are dispos
upon the skinne
are couched vnder
whole (scalp) and t
(for the upper is in
Muscles.

Of the

Before we
in this pl
hath bee
if the figure be ch
number, as Hippo
though I know th

Table 1. Sheweth
formation of the He

FIG. II.



FIG. III.



being ignorant of this membrane haue maintained that the bones themselves are not destitute of sense.

The Muscles about the head are very many, some arise from the lower part of the scull, others are disposed vnder the skin of the fore-head mouing it for the behoofe of the eyes, whereupon the skinne of the fore-head is rugous, full of transuerse and right lines; some also there are couched vnder the hairy scalpe, sometimes (for they are not perpetuall) by which the whole scalpe and the eares in some men are moued; Finally, others belong to the neather iaw (for the vpper is immouable) of all which wee shall particularly entreate in our Booke of Muscles.

The muscles
about the head

CHAP. IV.

Of the diuers Figures of the Head, the Sutures and substance of the Scull.

BEfore we come to entreate of the Bones and Sutures of the scull, which we purpose in this place but lightly to handle, it shall not be amisse to adde a little to that which hath beene already said concerning the whole figure and fashion of the head, because if the figure be changed then must the Sutures or seames needs alter both in scituation and in number, as *Hippocrates* saith in his Booke *de Ossibus*, and after him *Galen* in diuerse places, although I know that there are some great Anatomists who are not of this minde.

Table 1. sheweth the Figures of the Head. Figure 1. exhibiteth the Naturall and blamelesse conformation of the Heade on one side, the other 4. Figures are all depraued and faulty.

TABVLA I.

FIG. II.



FIG. III.



FIG. I.



FIG. III.



FIG. IV.



The Figure therefore of the head is double, Natural & Good, or else depraued. The Natural Figure [table 1, figure 1.] is that which is like a long spheare, on both sides neere the temples by little and little depressed and made narrower, but at each end shooting out; yet so that the back part is more capacious, that so it might stand vpon the Necke equally balanced. For because the fore-part though it be not so much embowed, yet by reason of the bones especially of the vpper iaw, is some-what heavy, it was needfull that the back-part should bee made as heavy by the capacity thereof.

A double fig.
of the head.
Naturall.

The depraued Figure is what soeuer varieth from the former description. I dare not call it in opposition to the former vnnatural, because some very good Anatomistes haue interposed their iudgements and determined that all figures of the head are Natural, albeit they vary somewhat from the exact forme: yet *Archangelus* calleth these depraued figures *Præter Naturam*.

Depraued 5.

This depraued Figure *Galen* in his

Table 2. sheweth some bones and sutures of the Head. Figure 6. sheweth the left side. Figure 7. sheweth the right side, the yoke-bone being removed.

TABVLA. II.

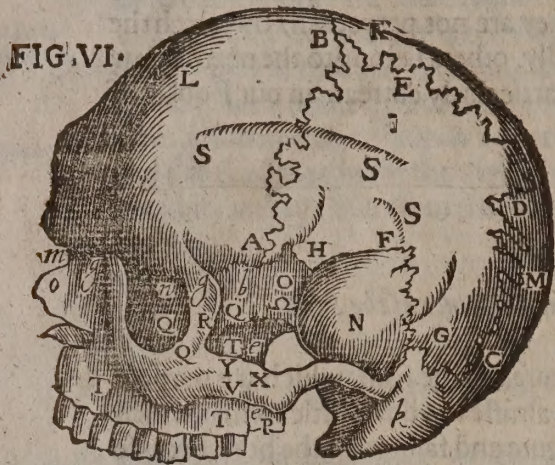


FIG. VI.



VII.

- AB, The Coronall Suture.
 CD, The Lambdall Suture.
 E, The Sagittal Suture.
 FGH, Ω , The fourth proper circular Suture.
 IK, The bones of the Sinciput.
 L, The fore-head bone.
 M, The Occiput or nowle bone.
 N, The bones of the Temples.
 O, The wedge bone.
 P, The fourth hole of the wedge bone in the orb of the eye.
 Q, R, S, T, Foare processes of the wedge bone marked with 2, 3, 4, 5.
 U, The first bone of the vpper iaw.
 V, The prominence of this bone toward the Temples.
 SSS, A semicircle in the skull, from whence the temporall muscle doth arise.
 TT, The fourth bone of the vpper iaw.
 UX, The yoke bone.
 Y, A suture in the yoke bone which some haue accounted for the fourth common suture.
 Z, Ω , 6, 44, 7, The fore-part of the fourth proper suture.
 b, The fifth proper suture of the skull running obliquely from H, to g.
 c, 7, A scale growing sometimes to the wedge-bone.
 d, 7, A line distinguishing this scale from the bone.
 ee, The lower part of the second common suture in the side of the pallat.
 f, 7, The first suture of the vpper iaw in the cheek.
 ggg, The first common suture in the side of the eyebrow.
 h, 7, A cavity of the temples made for the articulation of the lower iaw.
 i, The Appendix of the temples called Styloides.
 k, The mammillary processes of the temples.
 l, 7, The heads of the Occiput or nowle bone where it is articulated with the first rack-bone.
 m, 6, A suture betwixt the bone of the iaw and the fore-head. n, 6, The third bone of the vpper iaw.

m, 6, A suture betwixt the bone of the iaw and the fore-head. n, 6, The third bone of the vpper iaw.

his ninth Booke *de usu partium* and the 17. Chapter called by a Generall name $\rho\epsilon\zeta\delta\gamma$, for in that place he reckoneth the round and globy head as a kind of that $\rho\epsilon\zeta\delta\gamma$. There be three sorts of them. The first [*tab. 1, fig. 2.*] wherein the eminence or out bearing before, shooting from the vpper part of the fore-head is wanting, although the backward eminence in the nowle be faire to be seene.

The second is quite contrary vnto this, in which [*tab. 1, fig. 3.*] the backward out-shoot in the nowle is wanting but not that in the fore-head.

The third [*tab. 1, fig. 4.*] in which both the eminences or out-shoots are wanting. There may bee another added to these three which many esteeme but onely imaginary, and that is when the skull swelleth more in compasse toward each eare then it doth either forward or backward. For *Galen* in the place next above named saith and proueth (or at least seemeth so to doe) that this is a meere speculatine thing, but cannot be indeed in Nature, for then saith he the fabricke of the braine must needs bee ouerthrowne, yea it would proue a Monster and cannot liue. *Vesalius* is of opinion that *Hippocrates* maketh mention of this forme, and beside telleth a Story of an Innocent (as wee tearme them) or foole in *Venice*, whose braine was of that shape; *Falopius* gain-saies him, and aoucheth that *Hippocrates* made mention onely of three sorts, and that he mistooke the figure of the childs head at *Venice*, of the same minde also is *Eustachius*.

A fifth Figure.

There may bee a fifth figure added out of *Hippocrates*, and that is an acuminated or sharp figure, wherein the last figure is but a little altered. This figure, saith hee in his Booke *de aëre aquis & locis*, and the 35. Text, was first made by Art: for the Midwiues vsed to presse the heads

Table 3. Figure 8. Sheweth the fore-side of the Skull, as also the bones, the holes or perforations and the Sutures both of the Skull and of the upper Jaw.

TABVLA III.

- FIG. IIX.**
- AA**, A hole in the fore-head bone.
BB, The hole of the fourth bone of the vpper Jaw, which is in the Cheeke.
C, A hole of the second bone of the vpper Jaw, in the inward angle of the eye.
DD, The fourth hole of the wedge-bone in the outward side of the eye.
EE, The first hole of the same bone.
G, The second hole.
H, The third hole of the same bone in the seate of the eye.
II, The fore-head bone.
K, The left bone of the *Sinciput*.
L, The left bone of the temples.
M, The mammillary proceffe of the temples.
NN, The Wedge-bone.
III, The first bone of the vpper Jaw.
Δ, The second bone of the vpper Jaw.
Θ, The third.
Λ, The fourth in the left eye.
Ξ, The fifth bone of the vpper Jaw in the nose.
OO, The bridge or partition of the Nostrils.
P, The Suture in the yoke-bone.
Q, A part of the second common suture from the first *N*, to *S*.
RSTVXYZ, The third common Suture drawne oblique through the Orbe of the eye.
d, The first externall Suture of the vpper Jaw in the Cheeke, and from thence through the eye to *Q*.
b, The third externall Suture of the vpper Jaw from *b*, to *c*.
c, The second externall Suture of the vpper Jaw in the eye.
e, The fourth externall Suture reaching to *Ξ*.
f, The 6. externall suture of the vpper Jaw in the middle of the nose.
g, The second internall Suture in the Nose.
h, The seventh externall Suture of the vpper Jaw.
i, A bastard Suture of the vpper Jaw at the eye.

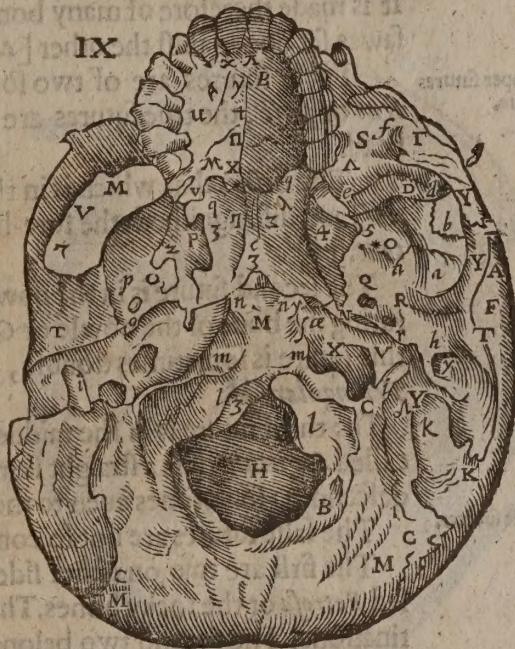


Fig. 9. sheweth the Basis of the Skull, and many holes and Sutures therein.

- A**, The end of the Coronall Suture.
CC, The lower additaments of the lambdall suture on either side.
D, The fourth hole of the wedge-bone in the outside of the orbe of the eye.
E, A part of the fourth proper Suture.
H, The great hole of the *Occipitium* made for the Spinall marrow. **K**, A part of the bone called *Sinciput*. **LL**, A part of the fore-head bone. **MM**, The lower part of the nowle bone. **N**, A rift or cleft of the Wedge-bone which is common to the bones of the temple, drawne on the left side from *n*, to *a*. **OO**, The Wedge-bone. **P**, His foure processe marked 2, 3, 4, 5. **AR**, The sixth hole of the Wedge-bone at the bottome of the throte. **A**, The seventh hole of the same at *R*. **I**, The first bone of the vpper Jaw. **S**, **Δ**, The fourth. **Π**, The sixth, where the cutter betwixt *c*, and *π*, hath not well expressed the Suture. **TT**, The bones of the temples on either side. **V**, The fourth hole of the bones of the temple made for the hearing. **Ξ**, The bridge or partition of the nose. **X**, The first hole of the temple bone in his Basis. **ΥΥ**, The yoke bone. **aa**, The anterior part of the fourth proper Suture. **b**, The lower part of the fifth proper oblique Suture. **c**, The lower part of the bridge of the nose which is like a coultter where 3. is placed. **d**, The vpper part of the second common Suture. **f**, The first externall Suture of the vpper Jaw in the Cheeke. **g**, The first common Suture in the side of the brow. **h**, The cavity of the temples whereto the lower Jaw is articulated. **i**, The *Appendix* of the temple bone called *Styloides*. **k**, The mammillary proceffe of the same temples. **ll**, The knob of the nowle bone. **mm**, The 6. proper oblique Suture of the Skull. **nn**, The seventh transverse Suture. **op**, A line beginning from the last named Suture which climeth by the temples, and is more like a diuision then a line. **qq**, The lower part of the 2. common suture of the Skull in the hollownes of the nose. **r**, The line of the hole of hearing. **sa**, The stony bones. **tv**, The 5. externall transverse suture of the vpper Jaw. **xy**, The 7. externall right suture. **αβ**, A bastard suture of the vpper Jaw in the Palate. **γ**, The hole of the eare. **δ**, The 5. hole of the temples nere vnto his proceffe where *γ*, should be blotted out. **B**, A hole of the nowle bone which is not alwayes found. **E**, The 2. hole of the nowle bone made for the 6. coniugation of the sinews and for the iugular veine and artery. **H**, The 1. hole of the *Occipitium* or nowle bone for the passage of the marrow. **3**, The 3. hole for the outgate of the 7. coniugation. **αα**, Two holes of the nose. **μν**, Two holes in the Pallate which is accounted the 4. of the Wedge-bone. **ξ**, Five holes in the Basis of the Wedge-bone. **π**, The hole of the 4. bone of the vpper Jaw in the Palate. Note that **M**, **V**, at the right side pointeth out the cavity which the yoke bone maketh for the passage of the temporall Muscles.

heads of Infants lightlie on euery side to make them rise sowewhat toward the crowne and after so rowled it with bands till that forme was confirmed; the reason was saith *Hippocrates*, because the people had an opinion that it was a signe of a generous and noble disposition to bee so featured; afterward Nature imitated Art and children were so borne; *Quintilian* in his second Booke and 17. Chapter, saith that *Pericles* had an acuminated head and somewhat long, and his words came thronging and thundring out, not peaceably as other men; so we see, saith *Bauhine*, that most of the French and low-Country men haue long heads, because they vse to lie with their heads vpon their Temples or on one side: whereas the Germanes haue most what round heads, because from their very infancy they lye vpon their backs.

Finally, *Vesalius* maketh mention of a Begger of *Bononia*, whose head was foure square, sauing that it was a little broader then long. And my selfe haue scene in *Lincolneshire*, a wondrous smal head made very like the ridge of a house neere vnto sharpnes al the length through, that boy was a foole and a wondrous great eater; and so much of the figures and fashions of the head.

A Sixt.
A Seuenth
scene in *Lincolneshire*.

The skull.

The skull or *cranium* is all that bone which compasseth the braine and after-braine like a helmet, which is not made of one bone, least this braine-panne by one wound should be broken throughout, as we see a pot wil be, the rift running quite through from the top to the bottom. It is made therefore of many bones ioyned together with sutures or seames like the teeth of 2. sawes set one against the other [table 1, and table 5, figure 13.]

Proper sutures
True.

These sutures are of two sorts, Proper and Common. The Proper sutures are either true or false, the true sutures are three, two of them transuerse, the third runneth along the head.

The first is that which is in the fore-part called *Coronalis* [table 2, A B, table 4, figure 11 n n] and distinguisheth the fore-head bone from the bone of the *Sinciput* [table 2, L, from I, to K.]

The second suture is in the nowle [table 2, C D, table 4, P P,] and is called *Lambdoides*, separating the bone of the nowle or *Occiput* [table 2, M, from I to K,] from the bone of the *Sinciput*: this suture is sometimes double, contayning in the middle a bone with three corners called *Triangulare os*.

The third suture is in the middest betwixt these two [tab. 2, fig. 1, E, tab. 9, fig. 2, O O] and is called *Sagittalis*, it is a straight seame and diuideth the bones of the *Sinciput* [tab. 2, fig. 6, I K] descending sometimes euen to the nose, especially in women.

False sutures.

The false sutures are not so conspicuous as the former; some reckon foure.

The first are two, on either side one aboue the eares and [tab. 2, F G H] aboue the bones called *Petrosa* or the rocky bones. They are not properly called sutures, but are rather scaly agglutinations. The second two belong to the bone called *Sphenoides* or the Wedge-bone, on the forepart and the hindpart.

Common sutures
true.

The common sutures are those that belong as well to the skull as to the vpper iaw, and they are five. The first is in the outside of the brow. [tab. 2, Fig. 6, and 7, g g, tab. 3, Fig. 8, R, Fig. 9, g.]

The second is double, the vppermost is in the outside of the eye and the hollow part of the Temples [tab. 3, Fig. 8, from s to 2, at Fig. 9, at d, tab. 2, Fig. 7, at d] The lowermost is at the sides of the pallat. [tab. 3, Fig. 9, from d to e,] The third is in the inner and laterall part of the eye. [tab. 3, Fig. 8, R S T V X Y Z] The fourth runneth through the middest of the Iugall bone [tab. 2, Fig. 6, X, tab. 3, Fig. 9, Y, Fig. 8, P.] The fift is in the bredth of the nose and is common [tab. 3, Fig. 9, vnder 2, to the *Sphenoides*, or wedge-bone and the bridge of the nose.

The vses of the
sutures.

The vse of the sutures is to giue way to the thicke and soory excrements; againe to tye the *Dura Meninx* to the Skull, and to giue way for the filaments of the same which make the *Pericranium* and *Periostium* as is sayd; and finally to giue ingate and outgate to the vessels.

The substance
of the skull.

Beside the sutures, the skull it selfe is crasse, rare and full of holes. Crasse or thicke for the security of that therein contained. Rare that it might not be too great a burthen; and full of holes [tab. 4, Fig. 11, 12, L, tab. 5, Fig. 14, e] to giue way to the transpiration of soory excrements.

His tables.

It is also made of a double table as we call it, or of 2. leaues [tab. 5, Fig. 14, 40] which may best be distinguished about the place of the browes; the outward of these may be eaten away by the French disease, the inner remaining sound. Betwixt these tables are conueied veines and arteries for the life and nourishment of the skull, among which vessels there is a kinde of medullous or marrowy substance [table 5, Figure 14, betwixt a, and O C] which some call *Meditullium*. These Tables are oftentimes perforated in many places

Meditullium.

places but without order, thorough which perforations small vessels passe into the inward cavity even to the *Dura Meninx*. On the out-side the skull is smooth, but if you turne the bottom vpward it is full of inequalities and protuberations. Of all which we shall entreate more at large in our Booke of Bones.

The perforation.

CHAP. V.
Of the Bones proper to the Skull.

THe Bones of the Head are of two sorts, some are proper to the Skull alone, some belong to the vpper jaw also. The bones proper to the Skull alone are six in number. (for wee goe not now precisely to worke to account the small bones of the eares) those of the jaw two.

The proper bones of the Head.

Table 4. Figure 10. sheweth the inner and lower part of the Skull, together with many holes especially those of the Wedge-bone. Figure eleventh sheweth the upper part of the inside of the Skull cut from the lower.

TABVLA IIII.

- A, The Wedge-bone.
B, His first hole.
C, The corner of that hole.
D, The anterior transverse canities of this bone in which the Optick nerues are hidden.
E, The latter of these fouresquare wherein the pituitary Glandule lyeth.
F, The forward passage, through which the Flegme gathered together is deriued.
G, The second hole of the Wedge-bone in the vpper part of the orbe of the eye.
H, The third in the bottome of the eye.
I, The small holes of the spongy bone.
K, A cleft of this bone through which the *Dura Meninx* istied.
L, 10, 11, The cavity of the forehead bone betwixt the two Tables.
M, The Wedge-bone in this place hath oftentimes a perforation.
N, A cleft or slit common to the Wedge-bone and bones of the Temples.
O, The last hole of the Wedge-bone.
P, The sixth hole.
R, The 7. hole in the chops at the bottome of the throat.
SS, 10, 11, and T, Certain inscriptions or furrowes in the Skull, impressed by the veines of the *Dura Meninx*.
V, The eighth hole of the Wedge-bone at the nostrils.
X, The fifth hole of the same bone.
Z, 11. The Fontanell.
ZZ, A cavity made for the forward extuberations of the braine.
a, The sixth hole of the Temple-bones, which is the fourth for the hearing.
b, The second hole of the nowle-bone.
c, The third.
d, The first.
e, The second.
fg, The two Posterior canities of the Skull.
h, 10, 11, The extremitie or end of the third and middle cavity.
ii, 11, A Bosome of this passage running thorough the length of the Skull.
i, 10, A Bosome common with the nowle-bone.
m, 11, Certain small holes in the inside of the bone of the *synciput*.
nn, 11, The Coronall Suture.
oo, 11, The Sagittall Suture.
pp, 11, The Lambdall Suture. q, 10, 11 The 4. Suture called *Squami-formis*. rr, The forepart of this Suture compassing some part of the Wedge-bone. s, A part of the Lambdall Suture, which some call the 6. proper suture. t, A line that ioyneeth the ends of the Lambdall suture, called by others the 7. proper transverse oblique suture. u, The eight proper transverse suture. v, The bridge or partition of the spongy bone. w, The processes of the Wedge-bone called *Clinoides*.

FIG. X.

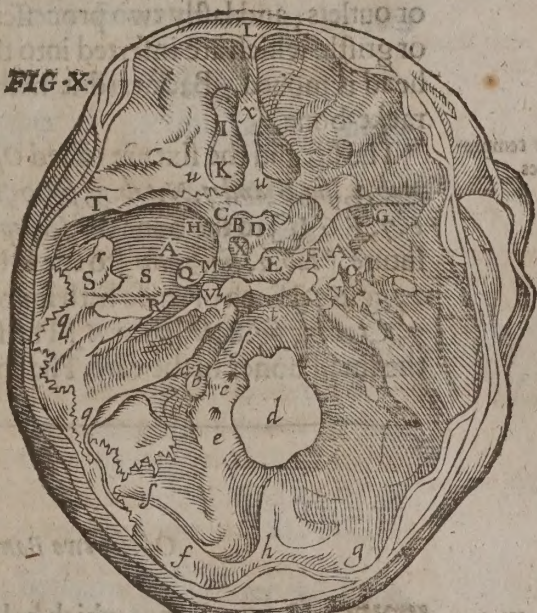


FIG. XI.



The

The fore-head
bone.

The first bone of the scull is called *Os Frontis* the fore-head bone: [tab. 2, fig. 6, 7, L, tab. 3, fig. 8, M] it is circumscribed with the Coronall suture, [tab. 2, fig. 6, C, fig. 7, AB] and that which is common to the head and the vpper iaw. [tab. 3, fig. 8, R, tab. 2, fig. 6, and 7, 8] In this bone on either side the browes [tab. 4, fig. 10, and 11, at L] there is a notable bosome or hollownesse, wherein is contained a soft and medullous matter, or happily it was framed to containe aer for the sense of smelling. It hath two processes, the one reaching toward the lesse, the other toward the greater angle of the eie, and make the vpper part of the orb thereof. The second and third are called *Ossa sincipitis*, [tab. 2, fig. 6, IK] they are full of dens or small holes on the inside with many inscriptions like the path of a snail or Emmet [tab. 4, fig. 10, and 11, SS] where the vessels run. They are fouresquare, of substance in respect of the rest very thin and weak. They are limited backward by the Lambdall suture [tab. 2, fig. 6, DC] forward by the Coronall [tab. 2, fig. 6, AB] and below by the scaly sutures of the Temple-bones. [tab. 2, fig. 6, GFH]

The sidebones
Ossa sincipitis.

The Noddle
bone.

The fourth is called *Os occipitis* the Noddle or Nowle-bone. [tab. 2, fig. 6, and 7, M, tab. 3, fig. 9, MM] It is ioyned aboue to the bones of the *sinciput* [tab. 2, fig. 6, IK] by the Lambdall suture; [tab. 2, fig. 6, CD] at the sides to the Temple-bones, [tab. 3, fig. 9, in C] in the middest to the wedge bone. [tab. 3, fig. 9, OO] The figure of it is almost round, the substance is very thicke and hard, yet but thin and weake at the side of the great hole made in it, [tab. 3, fig. 9, H, tab. 4, fig. 10, d] through which the marrow entreth into the racke-bones of the Necke. It hath nine bosomes or hollownesses. On the inside seven, on the out-side two. Fiue holes or outlets, and lastly two processes or heads [tab. 3, fig. 9, II] broad, couered with a Cartilage or gristle which are inserted into the cauires of the first rack-bone of the neck vpon which the head is moued. Backward it hath a small processe like a tooth which is receiued by the first racke-bone.

The temple-
bones.

The fift and the sixt are called *Ossa temporum* the temple bones, or *Lapidosae* the stony bones. [tab. 2, fig. 6, and 7, N, tab. 3, fig. 9, TT] They are ioyned aboue by the scaly suture [tab. 2, fig. 6, 7, FGH] to the bones of *sinciput*, below to the additament of the nowle-bone by the sixt suture, [tab. 3, fig. 9, mn] to the first bone of the vpper iaw by the fourth common suture. [tab. 2, fig. 6, Y] Each of these hath foure processes. The first is called *Mamillaris*. [tab. 2, fig. 6, and 7, K, tab. 5, fig. 8, M, fig. 9, K] The second is called *Styloides*. The third *Labyrinthus*, conteyning the small bones of the eare. The fourth is a part of the Iugall bone.

CHAP. VI.

Of the two Bones common to the Scull and the vpper Iaw.

The Wedge-
bone.



He two Bones which belong as well to the vpper iaw as to the scull, are called *Sphenoides* or the Wedge-bone, and *Spongoides* the spongy bone, called also *Cribiforme* or *Ethmoides*. The first is set like a Wedge (whence it hath his name) betwixt the bones before described and the bones of the vpper iaw, so that it toucheth them almost all. In infants it is made of foure bones, but after we are growne it also groweth into one entire bone. And because it hath many processes and inequalities on both sides, a man can compare it to no one thing, wherefore the Ancients called it *πολύμορφον*, as if we should say, *seare-shaped*. i. seuerally shap'd.

The substance of it is fast and strong, but the inside somewhat spongy. It hath many processes, two on the inside called *nasales*, two called *pterygoideis* like Bats winges, & foure small ones which make the *saddle* or seate.

It hath also many hollownesses or bosomes, some outward in the wingy processes, others inward, in which [tab. 4, fig. 10, at C] the Optick nerues are ioyned, then the saddle it selfe wherein is the glandule placed [tab. 4, fig. 10, E] which receiue the Phlegme, from whence afterward it floweth into the Palate and the Nofethrils.

It hath also many canities and ten holes, fiue in the orbe of the eye, and other fiue in the basis of the scul. The exact description of all which you must looke for in the book of Bones.

The Spongy
bone.

The second bone common to the Scull and the vpper Iaw is called *Spongoides* or *Ethmoides* *Cribre-forme*, because it is ful of holes as a siue or seare, but it may better be called the spongy bone, because the holes are not for the most part direct, but crooked & oblique like the pores of a sponge.

It is placed in the fore-part of the Skull without the meninges, and occupieth almost all the

Table 5. Figure 12. sheweth the inside of the wedge and spongy bones. Fig. 13. Two portions of the bones of the Sinciput a little disioyned the one from the other, that the frame of the Suture might bee better perceived. Fig. 14. sheweth a part of the bone sinciput divided with a saw from the rest of the same bone, the better to exhibite the substance of the Skull.

TABVLA. V.

FIG. XII



XIII



XIV.



- A A. The spongy or the eight bone.
- B. A bridge or partition diuiding the Organs of smelling.
- C D. Two cauities of the wedgebone.
- E. A partition distinguishing them asunder.
- F. A hole of one of the Cauities ending in the Nostrils.
- G. A right Cauity scituated vnder the two former.
- HH. Processees like to Bats wings.
- 14. The vpper or exterior Table 4, the interiour.
- 14. A cauernouse or spongy substance in the middest betwixt them called *Diplois*.

the cavity of the nose; it is ioyned to the middest of the bottome of the forehead bone, [Tab. 4. fig. 10, K] and is distinguished from the wedge-bone by the bastard seame called a Harmony, which is accounted for the ninth Suture. [Tab. 4. Fig. 10, above u] There are foure parts of this bone. The first is an vpper processe in the midst, long and triangular like a Cock-combe. The second is on both sides that processe [Tab. 4. Fig. 10, K I. Tab. 5. Fig. 12, A A] which is couered with a thin Membrane likewise perforated. The third is a lower processe opposite to the vpper which diuideth the vpper part of the nose into two parts. The fourth part is the substance it selfe of the *sponge* from whence it hath his name. The vse of it is to admit aer for the generation of Animall spirits, to admit vapours to the sense of smelling; but the pores of it are not direct but oblique & crooked, lest the cold aer should too directly ascend vnto the braine to refrigerate or coole it ouermuch.

The vse of it.

CHAP. VII.

Of the Meninges or Membranes of the Braine.



the lower belly and parts therein are compassed with the *Peritonæum*, & the middle with the *Pleura*, so there are two membranes stretched ouer the cavity of the Skull, which *Galen* and those who haue written since his time haue called *μνιρυς*. And indeed *Galen* had the name out of *Hippocrates* his booke de *Carnibus*, who there taketh it in a larger signification, which giueth

Galen.
Hippocrates.

that name to all parts that are hollow, as the veines, the stomacke the guts and such like. *Erasistratus* called these membranes *εμμενιδες*, *Pollux* *εμμενιδες*. The *Arabians* called them *Maters* the Mothers, and so now they are commonly tearmed. *Macrobius* called them *Omenta* or *kelles*. The one of these which is the outward is thicke and called *dura mater* the hard Mother, the other inward and thinne called *pia mater*, the deere or neere Mother, because it immediately incompasseth and imbraceth the substance of the braine.

Their names.

The *dura mater*.

His figure and magnitude.

Connexion.

Whether the braine mooue or no.
Platerus,
Columbus, *Archangelus*,
Laurentius.

It is double but not two.

The thicke *meninx* *Hippocrates* (in his booke *de locis in homine*) calleth *σκληρὴ* or *παχὴ* or *σκληρὰ δὲ μὲνινξ* that is, the thicke hard or skinny *meninx*, commonly the *dura mater*, because of all the membranes of the body it is the thickest, hardest and strongest, and particularly in relation to the thinner *meninx*.

In figure and magnitude this membrane answereth the bones of the Scull, because it incompasseth all his bosomes and cavities. It is greater then the *pia mater* or thinner *meninx* least if it lay too close vnto it the vessels that runne therein should bee compassed, which if they bee distended and swell too full of blood, doe cause the head-ach, yea oftentimes the Apoplexie; whence it is that many which dye of the Apoplexie, auoid blood out of their nose and their mouth.

It is tyed very strongly to the Basis of the Scull and to his sharper processe, and to the orbes or circles of his holes, [Tab. 11, fig. 7, 22] whereupon some haue thought that from this Basis it tooke his originall, because seede is the matter out of which this, as all other membranes are made. Notwithstanding it cleaueth not so close to that bosome of the wedge-bone [Tab. 4, fig. 10, E] where the Glandule of phlegme is situated, [Tab. 7, Fig. 15, A] nor yet at the sides thereof where those bosomes are which giue way to the branches of the sleepey arteries called *Carotides*. It incompasseth all the inside of the Scull, from which as also from the braine it hangeth in the like distance as doth the *Pericardium* or purse from the heart, least the eleuation and depression, or *Systole* and *Diastole* of the braine should bee hindred. I know full well (that wee may say something of it by the way) that *Platerus* thought that the braine it selfe did not moue, but that it was onely the pulsation of the third ventricle much like the beating of an artery, which wee feele in the Sculs of tender Infants before their bones are ioyned close together. But *Columbus* and *Archangelus* doe demonstrate a manifest *Systole* and *Diastole* of the braine from their experience in those whose Sculs are wounded and the bones taken out with a Trepan. And *Laurentius* thinketh him not worthy the name of an Anatomist that wil call it into question.

It is tied very strongly to the Scull by thinne and membranous fibres (which *Galen* in the 8. booke of the vse of parts and the 9. chapter, calleth *Ligaments*) arising there-from, which passe through the Suture of the Scull, especially about the *Lambdall Suture*, euery one of which *Ligaments* or fibrous ties chuse you whether, are extended over the parts of the Scull where against they issue, and running along are exactly vnited together and make that common Membrane which wee saide before was called *Pericranium*, vnder which there is yet another farre finer and thinner called *Periostium*; from which two membranes all the other membranes of the body haue their originall, that in this respect this *Dura meninx* may well be called *Mater*, as being the Mother of all other membranes. It is also knit to the *Pia mater* and to the braine by the mediation of vessels [Tab. 6, Fig. 2, DD GG. Tab. 11, fig. 8, xx.]

This membrane is double as are the rest of the membranes of the body; and *Columbus* makes two membranes of it, one inward another outward, and boasts himselfe of the finding of them: whom *Laurentius* closely taxeth confessing that it is indeed double, but they are not therefore to bee called two membranes; so saith he, we do not say that there are two rims of the belly, and yet wee know that the *Peritoneum* is double. Well, it hath a double superficies or surface; the outward like a broad Tendon is stretched ouer the other and groweth vnto it; hard it is and rough, partly by reason of the fibres which if you take away a piece of the Scull you may perceiue a little to swell vp like a small line, [Tab. 6, fig. 1, GGG. HH, II] partly because in the crowne of the head where the sagittal Suture meeteth with the Coronall, there are certaine small knubs or knots, which in the Scull haue their proper bosome wherein they couch and to which they grow very fast. [Tab. 6, fig. 1, K.]

The inner superficies or surface is bright, smooth, slippery and much whiter without any such knubby or kernelly substance or fat (what you will call it) at all; moistened also with a watery humor, [Tab. 6, Fig. 2, HH] whereas the vtter is dryer. On the inside also it is of exquisite sense, but on the outside not so that it might better endure the contraction of the bone

Table 6. Figure 1. is covered with the gathering with the *pia mater*.

FIG. 1.

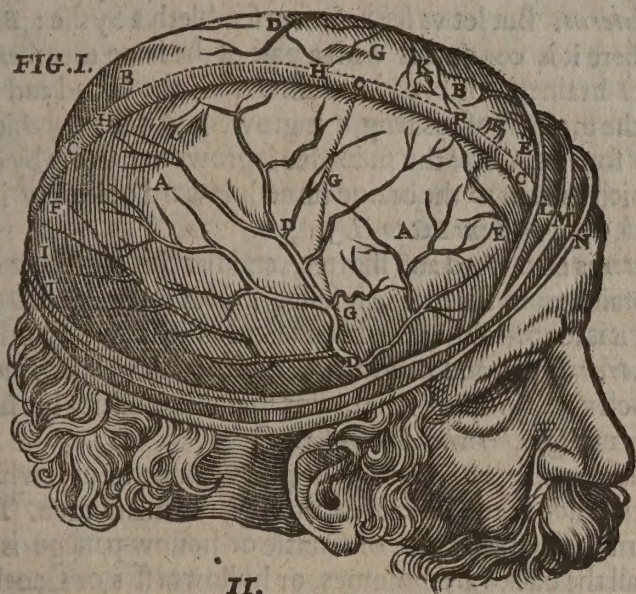


bone without offense. It hath many bones, and the 6. chapter negations or paires and that round as also others at the 12. Fig. 11, C and D descendeth out of the gy bone, it is perforated in the top of the and a left, even as a plication lyeth all a the bosome through

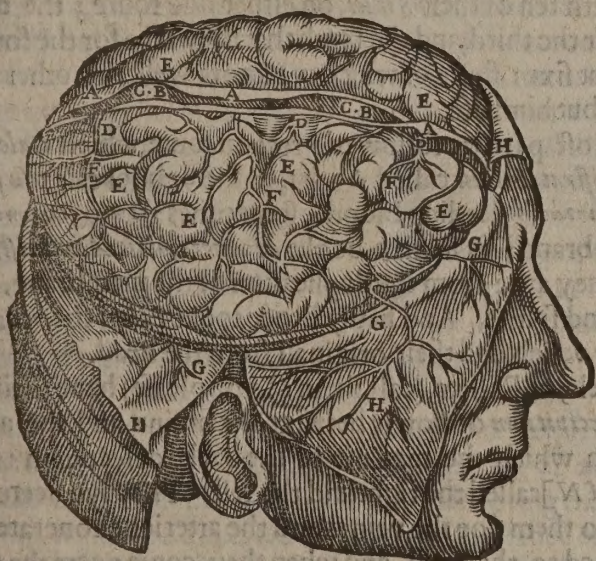
Table 6. Figure 1. sheweth a head, the scull being taken away, that so the braine may appeare as it is covered with the dura meninx. Figure 2. sheweth the Braine cleared from the Dura meninx, together with the third Sinus thereof, divided through the middest, which is shewed covered with the Pia mater.

TABVLA. VI.

FIG. I.



II.



AA, BB. The Dura meninx or thick membrane.

CCC. The third Sinus of this membrane.

DD, The course of the veines as they run through the membrane, or the second veine of the braine.

EE. The first veine of the braine.

FFF. Certaine small veines which perforate the scull and reach to the pericranium or Skull-skin.

GGG. Fibres of the Dura meninx passing through the Coronall Suture, which fibres make the Pericranium.

HH. Fibres passing through the sagittal Suture.

II. Others passing through the Lambdall Suture.

K. A knob which vseth to grow to the Sinus of the Scull.

L. A cavitie in the forehead bone.

M. The Scull.

N. The Pericranium or Scull-skinne.

Fig. 2.

AAA. A part of the Crasse meninx diuiding the braine.

BB. the third Sinus of the same Crasse membrane opened.

CC. the beginning of the vessels out of the third Sinus into the Pia mater.

DDD. the propagation or brâches of these vessels. EEE. the Pia mater or thin meninx immediately compassing the braine. FFF. Certaine vessels running through the conuolutions or branches of the braine.

GGG. Certaine brâches of veins running through the sides of the dura meninx.

HHH. The thicke membrane reflected downward.

bone without offence.

It hath many holes or passages in it, first of all (saith Galen, in his 9. booke of the use of parts, and the 6. chapter) to giue way to many veines; againe, for the outgate of the Coniugations or paires of the sinewes. Moreover in the middest it hath one notable perforation and that round, to let out the braine Tunnell, called *Infundibulum*, [Tab. 12, fig 11, F] as also others at the sides of the former to admit the sleepey arteries called *Carotides*, [Tab. 12, Fig. 11, C and D] and one larger then all the rest through which the marrow of the back descendeth out of the braine. [Tab. 12, Fig. 9, H] Finally, where it is stretched over the spongy bone, it is perforated manifold like a Sieue. [Tab. 14, Fig. 18, at F, and figure 9, at FF.]

In the top of the head it is redoubled and separateth the braine into two parts, a right and a left, euen as low as the center thereof. [Tab. 10, Fig. 13, from D to B] Which Reduplication lyeth all along the third bosome or Sinus of this hard membrane & runneth with the bosome through the length of the head forward vnto the top of the nose, and groweth fast

His holes or Passages

His Reduplication.

fast vnto the distinction of the mamillary processes, [tab. 9, Fig. 3, N] euen as it groweth backward in the middest to the hinder proceffe.

The Sythe

This Reduplication of the *dura meninx* is called the vpper proceffe and is likened by all the best Anatomists to a Mowers Sythe, and *Laurentius* is not affraid to call it *Falx* or the Sythe, and saith that this reduplication makes the body of the same: but *Vesalius* saith that the proceffe which is like a Sythe is not duplicated but simple as the membrane it selfe is simple, and seemeth onely to bee double because of the bosome which parteth the braine, of the same kinde also is *Platerus*. But let vs see how it resembleth a Sythe: *Bauhine* fashioneth it thus. Backward, (where it is continuall with a part of the same membrane which couereth the *Cerebellum* or after-braine) it is broad and answereth the broad end of the Sythe, [tab. 9, Fig. 3, as D] about the middest of his length it groweth to bee very thicke like the backe of the Sythe, and the fore end is like the point, for it groweth narrow by degrees and therefore that part of it which is next to the braine turneth inward obliquely iust like the hooking point of a Sythe. [tab. 9, Fig. 3, from FG to H.]

The other proceffe of the *Dura Meninx*.

The other proceffe of the *Dura mater* is backward and shorter, and for the most part distinguisheth the *Cerebellum*, or after-braine from the braine it selfe, [tab. 11, Fig. 7, 0000] Beside it couereth the *Cerebellum*, and it is foure-fold as thicke and hard as it is in any other place saith *Columbus* and with him *Archangelus* and *Laurentius*, *Vesalius* saith three-folde. Dogges in this place haue a bone which vnderproppeth the braine that it should not lye heavy or beare vpon the *Cerebellum*. [tab. 11, Fig. 7, betwixt 00 and XX.]

A bone in Dogges.

Two kinds of Cauties.

In this membrane there are found two kinds of Canales or pipes; one through which the vessels are carried, as the Arteries which are disseminated through the membrane. The other into which the veines do determine, which kinde of Canale or hollow passage is to it instead of veines; and these they call the backward bosomes, or hollowneses, or Canales, (for other words to expresse a *Sinus* I cannot deuise) of which we will immediately intreate.

Fallopins his ten *Sinus*.

Fallopins in his obseruations reckoneth ten of these *Sinus*, on either side foure; the ninth is that which other Anatomists take for the third, and the tenth that they take for the fourth; but in his institutions hee reckoneth but sixe: foure of which we know well, the other two saith *Bauhine*, I thinke no man knowes but himselfe.

Foure *Sinus* of the *Dura mater*.

We with *Bauhine* (whom for the most part we follow) do reckon foure, which *Galen* in the ninth booke de *Anatomicis Administrationibus* called *σπλάγχις*, in the 9. booke de *usu part.* and the 6. chap. sometimes *meningis σπλάγχις* leading blood: sometimes *τὴν παχέαν μνίγγα* *νοτίαν* the ventricles of the thicke membrane; as in his 9. booke de *Anatomicis Administrationibus* and the fift chapter, because they arise from the duplication of the membrane, and are as it were Rillets carrying blood and spirits. And haply hence tooke *Pelops* the occasion of his error, who auouched that all the vessels had their originall from the head.

Pelops his error whence. The two first *Sinus*.

The two first of these *Sinus* or Canels, or Rillets, (call them as you please) haue their beginning behind in the Basis of the *Occipitium* or nowle betwixt the braine and the after-braine at the sides of the hole through which the marrow of the backe descendeth: they are one on each side, [Tab. 7, fig. 13, M N] called the right and the left. They lye neere the sides of the *Lambdall Suture*, and into them doe the veines and the arteries exonerate and vnburden themselves. They are fastened to the Scull, and when they come neere the middle of the *Lambdall Suture* and the top of the *Cerebellum*, they ioine in one and make a common cavity, which place [Tab. 7, fig. 13, O] *Herophylus* (saith *Galen* in his 9. booke of the vse of parts and the 6. chapter, and in the 9. of his *Anatomicall Administrations* and the first) called *λυστή* that is, *Torcular* the presse, because from thence as from a high place the Rils runne downe on either side; some of them out of the middest of it are deriued into the whole after-braine, others run from the forepart, from whence, as wine from a grape-presse, the blood poured out of the veines and arteries is squeezed into the whole braine. From these on eyther hand at the sides runne small branches like veines, some of them as small as a very haire, some of them larger, [Tab. 7, fig. 13, SS] which runne out into the bordering membranes, both the thicke one [Tab. 11, fig. 7, 000] and the thinn one [Tab. 12, Fig. 9, B D] where they couer the whole *Cerebellum*.

Galen

The presse of the braine.

Out of the concurrence of these [Tab. 7, Fig. 13, O] doe arise two other *Sinus* or Rils differing in length and in the fashion of their cauities. The one of them is the higher and is called the third *Sinus* [table 15, figure 13, PP] the other the lower called the fourth [table 7, fig. 13, R]

The third *Sinus* which is like a Rill of blood (called sometimes by *Galen* a veine and not vnpro-

vnproperly (for what should you call a vessell in which blood is contained but a veine, though it haue not the coate of a veine?) though some thinke it to bee *Herophilus* his *presse* of which wee spake euen now) passeth directly forward through the length of the head [table 6. fig. 1, and 2, C C C] betwixt the right and left parts of the Braine vnder the vpper part of the Lambdall Suture and vnder the Sagittall Suture, and vnder the middle of the forehead bone and in the top of the nose is ioyned to the bony partition [tab 7, fig. 13, Q] of the organs of smelling, and would bee like a triangle, sauing that in the vpper part it is some what neere to a *semicircular* forme: for the cavity of this *Sinus*, as also of the two former, haue two crooked ribs as it were inward, and the third curued outward.

From this *Sinus* or canale on either side the braine all along the head there arise very thicke certaine vessels as it were branches out of a great trunk of a veine which *Galen* calleth *οχορτις* of which some are but small which they call *venas reptitias*, the creeping veines. Of these some arise from the higher part of the *Sinus*, some from the lower, some from the sides thereof. Those which arise out of the higher part [table 7, figure 13, XXX] which is next the skull, do runne vpward to the duplication of the skull, that is to the porie substance betweene the tables thereof, and to the *Pericranium*, and mingle themselves with those small vesselles which descend from the skinne of the crowne and passe through the skull at small pores thrilled therein for the same purpose. Those which arise from the lower part of the canale, that is, which is next the braine [table 7, figure 13, VVV, table 9, figure 3, EE, HH] are but small and runne downward onely into that part of the *dura meninx* which euen now wee called the *fithe*. Those which arise out of the sides of the *Sinus*, that is out of the bredth of it [Table 7, figure 13, TTT, tab. 8 figure 2, DDEF] are infinitely diversified into the *pia mater* and together therewith into the conuolutions of the braine; & where the *pia mater* endeth they proceed on into the very substance it selfe of the braine. These vessels sometimes opening, so great a quantity of blood hath yssued by the Nose thrills, that it is credibly reported to haue amounted to 24. pound: in which kinde of fluxe wee must not apply medicines to the forehead, but either to the crowne or to the coronall suture.

Columbus was of opinion that these vessels do not arise out of the *Sinus* it selfe, but out of the veines running threin, for he thought that the internall iugular veines passed through it. *Archangelus* also seemeth to incline this way, who sayth that though the two former *Sinus* or rils, the inner iugular veines and arteries doe passe and insinuate themselves into the third *Sinus* and so run out to the nose, yea backward also to the fourth *Sinus* and quite through it.

The fourth *Sinus* saith *Vesalius* the professors of dissection haue not remembered. It is no where neare to the skull as the others are, but seated in the lower part of the braine: very short it is and runneth directly betwixt the braine and the after-braine to that part of the braine called *Nates* or the bottocks, and the glandule called *pinealis* (for such representations there are in the substance of the braine [Tab. 7, fig. 13, R, table 11, figure 7, T] and the cavity of it is like a triangle made of three equall ribs curued inward. The beginning of this cavity, or rather truth to say the meeting of all foure [Tab. 7, fig. 13, Q] some call the *Torcular* or the presse; and from hence do spring the veines, saith *Columbus* and with him *Bauhine*, which are dispersed through the substance of the braine to nourish it.

From this *Sinus* also in his progresse doe issue small branches, some of which runne vpward to that part of the *dura mater* which is aboue the *Cerebellum* and as farre as to the *fithe*, [Table 7, figure 13, YY] others downward [Tab. 7, fig. 13, a a] which are dispersed into the *dura mater*, where it lyeth about the after-braine, as also into the *pia mater*, both where it compasseth the after-braine and the braine it selfe.

Afterward this *Sinus* is diuided into diuers rillets; two issue out of the vpper part of it and one out of the lower; of the two which issue out of the vpper part, one is greater, another lesse.

The greater [table 7, figure 13, b] creepeth along the lower part of the *dura meninx* where it deuideth the braine in his length; from which certaine furcles runne [Tab. 7, Fig. 13, c c c] vpward to the proesse of the same *dura mater*.

The lesser which is double, a right and a left [Table 7, Figure 13, de. table 3, Figure 3, II F G G] supported with a thinn membrane after the manner of veines are ledde through the length of the braine on either side aboue the callous body called *Corpus callosum*, and afford some small twigs to the *pia mater* which are distributed on either side into the braine.

The lower rillet [Table 7, Figure 13, f] is but one propagated into that part of the *pia mater* which compasseth the *Cerebellum*; but it is diuided into two branches, one of them run-

Branches from the 3. Sinus.

Great quantity of blood out of the hole whence it comes.

Columbus. Archangelus

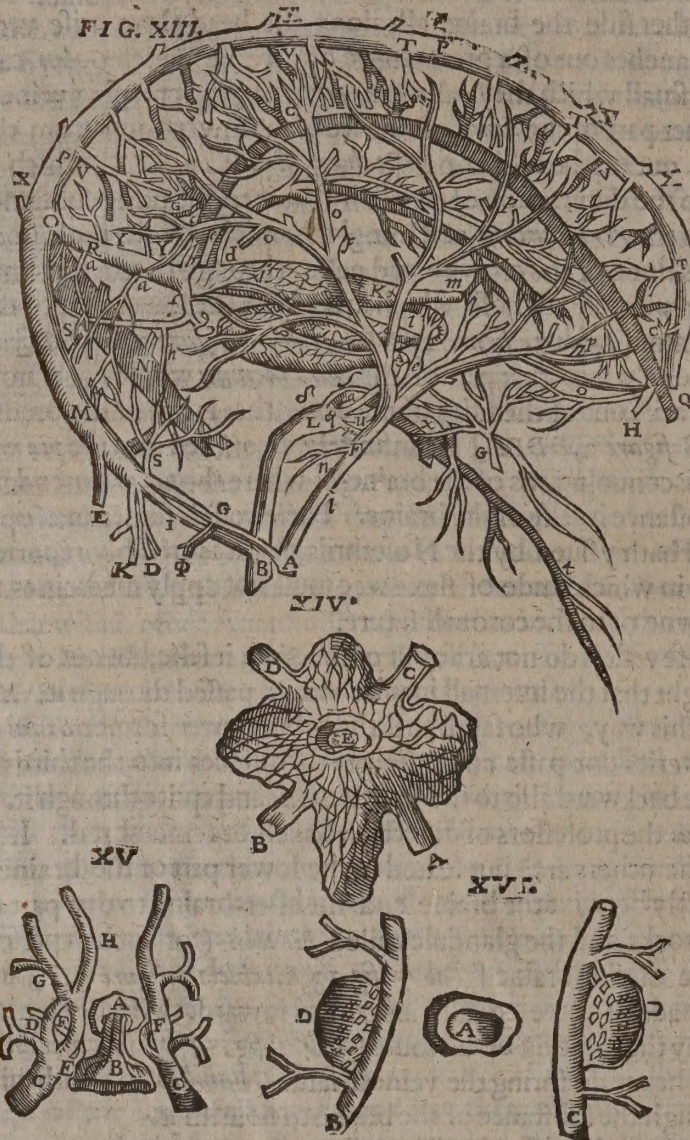
The fourth.

Branches from the 4. Sinus

The vpper.

Table 7. Figure 13. exhibiteth the vessels of the Braine and their distribution, especially through the right side, whither they proceede from the internall Iugular veine, or from the sleepe Arterie, or from the sinus of the Dura Meninx. Figure, 14, sheweth the wonderfull Net as Galen describeth it. Figure 15. sheweth the pituitary Glandule with the Bafon and the sleepe Arteries. Figure 16 sheweth the Rete-mirabile or wonderfull Net, together with the glandule as it is found in the heads of Calves and Oxen.

TABVLA. VII.



- A. The internall Iugular veine.
 B. The sleepe or Iugular artery,
 C. The first veine.
 D. the 2^d veine which is led vnto the Sinus.
 E. the 3^d, creeping through the dura meninx.
 F. the fourth running into the Sinus.
 G H. the 5th and 6th going to the dura meninx.
 I. the first Artery.
 K. A branch of the same Artery running through the Muscles of the necke.
 L. the second artery reaching into the sinus.
 M. the third without a companion.
 N. A small branch of the third artery.
 O. the 1st and 2^d sinus of the Dura Meninx.
 P. the congresse or meeting of both those sinus. P P, the 3^d sinus of the Dura Meninx.
 Q, the end thereof.
 R, the fourth sinus of the Dura meninx.
 S S Branches of the first Sinus deriued into the Membranes nere at hand.
 T T T T. Branches of the third Sinus disperised into the Pia Meninx.
 V V, the lower small branches of the third Sinus.
 X X, the vpper distributed through the Dura meninx.
 Y Y, certaine surcles of the 4th Sinus sent vpward. aa, Others sent downward.
 b, the vpper passage of the fourth sinus running by the Syth.
 cc. Surcles running vpward from this

passage. de. The right and left vpper branches of the fourth Sinus. f, The lower branch going to the Pia mater. g, A branch of the same passing forward. h, The same bending backward to the Choroides reflected to the Cerebellum. i, A notable vessell into the which the 4th Sinus doth determine. K, The vpper. The by-partition of this vessell in the braine. lm. Two branches of this by-partition. n. A surcle reaching to the organ of hearing. o o o, The distribution of the 3^d veine and artery. p p p, Surcles proceeding from the Branches marked with o deriued into the pia mater. q, The diuision of the third artery where it entreteth into the scull. f. A branch reaching to the hollownesse of the nostrils. t, The end of this in the extremitie of the vessell. u u, 2 branches entring into the scull. x. A branch deriued vnto the eye from the coition or meeting of the branches. u u, e, A branch attaining to the pia mater. A, A branch attaining to the right ventricle. s, The complication of vessels called Plexus Choroides formed on either side of the branch marked with A. Fig. 14. A B, Arteries climbing into the scull, and making this wonderfull net. C, D, Branches into which the surcles of that net are ioyned. E, The pituitary glandule or kernel of flegme. Fig. 15. A, the Glandule receiuing the bafon. B, the bafon it selfe, or if you will, the Tunnell called Peluis or infundibulum. CC, the sleepe Arteries. D. A Branch of the artery going to the side of the Dura Meninx. E, Another branch of the same artery going to the nostrils. FF, An artery in one side diuided into 2 branches, but in the other side meeting together againe. G, A partition of the artery creeping through the dura meninx. H, Another branch which getteth out of the scull and reacheth to the eyes. Figure 16. A, The pituitary Glandule. B, C. The sleepe Arteries going into the scull. D, D. The wonderfull Net.

neth forward [Tab. 7, fig. 13. g] through the Circles of the braine and endeth in the lower seate of the ventricle, and is ioyned with an artery ascending thither [Tab. 7, fig. 13. y] to make as they say that web of vessels which they call *Plexus Choroides*, because it is somewhat like the after-birth called *χορίον*. The other branch is reflected backward to the *Cerebellum* [Tab. 7, fig. 13. i] and is diuersly sprinkled into his *pia mater*. Finally, and at length this fourth *sinus* determineth into a notable vessell couered with the *pia mater* [Tab. 11, fig. 7, v. tab. 7, fig. 13. i] which neere the testicles of the braine, so called, is diuersly diuided and knotted and so goeth vnto the Glandule called *Pinealis* and vnder the arch of the braine called *Fornix* runneth in to the inside of the third ventricle and there is parted into a right branch and a left. The right branch reacheth [Tab. 7, fig. 13. l] vnto the right ventricle and the lefte vnto the left. [Tab. 7, fig. 13. m] & Anatomists do think that they are mingled & ioynd to the branches of the first and fourth arteries to make that *plexus Choroides* of which we made mention euen now.

Where the 4
sinus endeth.

These *sinus* or cauities of the *dura meninx* haue not the coats of veines but are in substance like to the *Meninx* it selfe. For as soone as the veine (put case the internall iugular) toucheth the scull, the *dura meninx* is there presently duplicated and the inside becommeth fistulated or hollowed like a pipe, and with these pipes as if they were veines the veines themselves are ioyned. They do the office both of veines and arteries, for they beate like arteries sayth *Platerus*, they receiue into them both veines and arteries (although *Fallopian* thinke they receiue only veines) and the blood and spirits of them both. For they are full of blood which they preserue as they receiue it full of spirits, but after death this blood cloddeth into a grainy substance, haply because the blood they receiue out of the vessels is a little thicker then ordinary saith *Bauhine*. They send also out of themselves scions and surcles like to the branches of Veines which passe vnto the Braine and both the Meninges.

The matter of
these *sinus*.

They doe the
office of veins
and arteries.

For because the Braine is large and standeth in neede of a great quantity of blood, but yet cannot admit any notable branches of Veines and Arteries to runne thorough his substance, Nature made these *sinus* or rilllets to bee in stead of veines and arteries to passe thorough and irrigate or water the whole substance thereof: for into them there is continually powred great abundance of blood which is mingled, the Venall I meane with the Arteriall, and afterward conueyed by these pipes vnto the convolutions of the Braine, yea into his very substance, aswel for his nourishment & life as also for the generation of the Animal spirits which are wrought within his substance. For seeing these Animal spirits are continually supplied vnto the instruments of sense and motion, and by motion are spent & dissipated, it was necessary there should bee great quantity of both kinds of blood in this place mingled together to make supply of them.

Why the brain
needeth much
blood

The vse of the *Dura Meninx* is, to hold together the whole substance of the Braine and bee a couering thereunto and to all the parts of it, for it compasseth about the spinall marrow also, yea and all the Nerues that yssue out of the Braine. It also defendeth the brain from the impressions of the Scull or compressions if by any outward iniury it bee beaten downward. It also preserueth the Arteries which runne in the surface of the Braine, that in their *Diafole* they be not offended by the hardnesse of the Scull.

The vse of the
Dura Mater.

Moreouer, it diuideth the Braine from the after-braine or *Cerebellum*, as also the Braine it selfe into a right part and a left. Finally, it produceth Ligaments through the futures of the scull to make the *Pericranium* and to fasten it to the scull, that it might not sinke downe toward the braine, as also to hold vp the Braine it selfe least settling downe it should presse the Ventricles which would cause sudden death. And thus much concerning the *dura mater* or *Meninx*, wherein wee haue beene somewhat prolix, that nothing might escape worthy your obseruation. Now it followeth that we intreate of the *Pia Mater* or thin *Meninx*.

The *Dura mater* being taken away we meete with the second Membrane called *Pia mater*, delineated vnto you in the first Table and the second Figure, but in the ninth Table and the third Figure P P sheweth the *Dura mater* & O O the *Pia Mater* of which we now speake. This Membrane euen considered of it selfe, as also in comparison with the other Membranes of the body is exceeding thin, and therefore called *λεπτὴ μνίνηξ* by *Galen* in his ninth Booke *de Administrationibus Anatomicis* and the second Chapter. The name he had out of *Hippocrates* his Booke of the Falling sicknesse, where hee saith that this *λεπτὴ μνίνηξ* diuideth the middle of the Braine, or the Braine in the middest. *Galen* also in his eight Booke of the vse of parts and the ninth Chapter calleth it *μνίνηξ χοροειδής*, that is the Membrane like the *secundine* or after-birth, because it conteyneth or holdeth fast the veins and arteries of the Braine, least whilst they mooue they should be displaced, their basis or foundation being but weake and infirme.

The *Pia mater*
or *tenuis Me-*
ningis.

His names:

This

His figure.
Magnitude.

Substance.

The court fell
of Nature.

This membrane is for the most part conteyned within the skull immediatly covering the braine, and there is iust of his figure. In magnitude answerable to the braine and the parts thereof; but the substance or body of it is exceeding thinne and fine, and yet *Cabrolus* and *Laurentius* say it is double. It is thinne that it might more easily insinuate it selfe into the conuolutions of the braine, and yet not be offensive by the weight of it to the brayne vpon which it lieth, & beside to carry the vessell quite through the same [Tab. 6, Fig. 2. EEE. tab. 9. Fig. 3, 00] It is soft and of exquisite sence because it communicateth the Tactile vertue to the Brayne and the Nerues; and *Archangelus* sayeth it is the very instrument of *Touching*.

This Nature placed betweene the brayne and the *dura meninx*, least the brayne saith *Galen* in his 8. booke of the *Vse of parts* and the 9. Chapter, should bee offended by so hard a neighbour. For euen as saith *Plato* betweene the earth and the fire because their natures are very contrary, God interposed the water and the ayre, so *Galen* saith that nature betwixt the brain and the skull which are partes of very different substance, hath placed these 2. membranes or meninges. For if there had bene none but this thinne *pia mater* it could not haue agreed with the skull without offence, if there had bene none but the *dura meninx*, yet the braine would haue bene therewith offended. That therefore neither the braine nor his cover should indure any vncouth violence, Nature hath immediatly covered the Braine with this *pia mater*; and then the *pia mater* hath she compasseth with the thicker; for by how much the thicker is softer then the bone, by so much is the braine softer then the thinner.

If you would know what distance there is betweene these two membranes, you must make a little hole in the thicker, and then put a hollow bugle to it and blow it, and you shall perceiue the distance betweene them will containe a great deale of ayre, by which you may imagine how farre they were seuered when the man was aliue.

The progresse
of it.

This membrane doth not onely cleave closely to the braine and couer it immediatly as his naturall coate, as a mother embraceth her infant (whence *Platerus* thinketh it was called *pia mater*) least the soft and moyst substance thereof should bee scattered or suffer diuision by the continuall motion wherewith it is wrought vp and downe (for wee perceiue that the braine will easily runne abroad when it is taken away) but also it insinuateth it selfe into the bottome of the braine, and extendeth it selfe vnto the inside of the cavity of his ventricles saith *Galen* in his 8. Booke of the *Vse of parts* and the 8. Chapter, lining them round within. The vulgar Anatomistes saith *Laurentius* thinke that it passeth into the ventricles from the vpper part of the braine; but the truth is that it ascendeth from below where the *Infundibulum* or Tunnell of the braine is scituate, and where those small arteries deriued from the sleepey arteries called *Carotides* doe passe into the braine at the sides of the wedge-bone; so that euen in the bottome it meeteth; without the skull it cloatheth the narrow of the backe and the nerues. The bones also saith *Archangelus* doe seeme to bee couered with this thinne membrane, which now hauing with his vse changed his name is called *Periostium*. But how it maketh the *Infundibulum* or Tunnell called also *Peluis* the Bason, and how it inuesteth the vpper part of the phlegme-glandule, we shall declare afterward.

Archangelus.

The vse of
the *pia mater*.

The Vse of it is, to couer and establish the braine, the after brain, the marrow of the spine and the nerues, as also all the vesselles which runne through it, it knitteth together, so that they are more safely and commodiously distributed through the whole body of the Braine & through all his parts. Adde hereto that which *Archangelus* determineth in the first Booke of his Anatomy, that it is the most exquisite and proper instrument of the sence of *Touching*.

CHAP. VIII.

Of the vessels disseminated through the Brayne.



THE vessels disseminated through the Braine are Veines and arteries and those *Sinus* or Canales whereof wee intreated at large in the former Chapter.

The veines.

The Veines are branches of the inner or vter Iugulars: the Arteries of the *Carotides* or sleepey Arteries, and of that wee call *Cernicalis* or the artery of the necke.

The inner iu-
gular.

The inner Iugular at the Basis of the skull in the backpart [table 7, Figure 13, at A] is diuided into two branches, one bigger which watereth the backpart, and another smaller branching forward. The bigger [Tab. 7, Fig. 13, the lower C] attaineth into the braine at the first

first hole of the No-
braine at the leu-
The vter iugular
enters into the Sin-
Fig. 104 The seco-
the wedge bone
into the dura men-

FIG. XII



ZV



make the Rete mirabile
abranco obliquely,
temple-bone, and the
13, through the ei-
15, the other iawa-
into the Dura meninx
The third artery [T
much lesse then the fir-
to pallet into the Sin-
There is also one oth-
perforateth the dura m-
Skull at the same larg-
the Glandule called
compellit the Plexus C
Beside these veines

first hole of the Nowle-bone. [Tab. 4. fig. 10, b] The lesser, [Tab. 6. fig. 1, DD] getting into the braine at the seventh hole of the wedge-bone. [Tab. 4. fig. 10, R.]

The viter Iugular veine sendeth three branches into the Scull: the first [Tab. 7. fig. 13, E] entreth into the *Sinus* of the *dura meninx* through the hole of the temple bones. [Table 4. Fig. 10, e] The second [Tab. 7. Fig. 13, G. Tab. 14. Fig. 19, HH] passeth in at the second hole of the wedge-bone. [Tab. 4. Fig. 10, G] the third [Tab. 7. Fig. 13, H. Tab. 14. Fig. 19, II] is distributed into the *dura meninx*, and getteth in at the hole of the spongy bone.

The viter Iugular.

Beside these five veines, *Vesalius* and *Platerus* add another, to wit, the end of the Necke veine which entreth the Scull (say they) at the third hole of the Nowle-bone which was purposely made for it. But *Banhuine* could neuer obserue it; yet wee haue added it in the Table. [Table 7. Figure 13, D.] Thus much of the veines, now of the arteries.

Another veine of Vesalius and his finding.

The sleepey artery called *Carotis* when it is come on either side to the Chops is diuided into two branches, one exterior of which heereafter, the other interior which is the larger of the twaine. This at the Basis of the Scull [Tab. 7. Fig. 13, B] is diuided into 2. vnæquall branches. The first is a little lesse then the Trunke, [Tab. 7. Fig. 13, L. Fig. 15, CC. Tab. 14. Fig. 19, P] it pierceth the Scull through a proper hole of his owne thrilled in the temple-bone, passeth vnto the saddle of the wedge-bone and then sheaddeth a branch on each hand into the side of the *dura mater*, [Tab. 7. Fig. 15, D] & afterward being diuersly carried and diuided (as wee shall heare more distinctly in the booke of veins) it helpeth to

The arteries.

The first

The second,

The third.

A fourth.

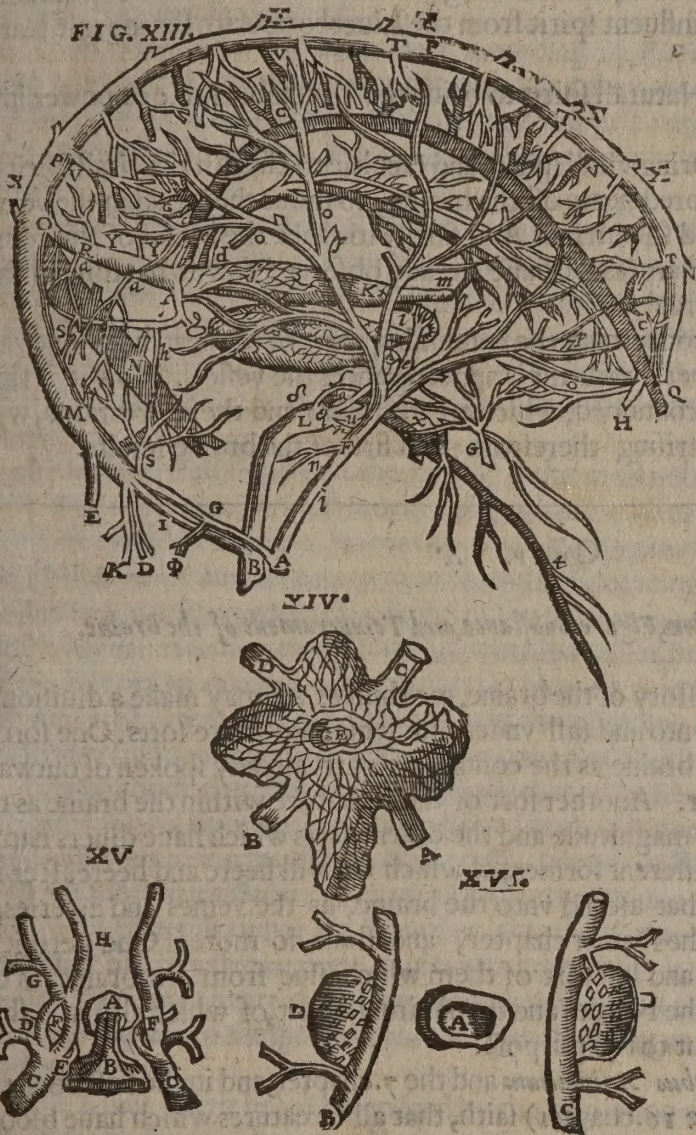
The *Sinus* of the *Dura meninx*.

make the *Rete mirabile*. [Tab. 7. Fig. 14] and the *Plexus Choroides*. From this first issueth a branch obliquely, [Tab. 7. Fig. 13, q] and getteth into the braine at the second hole of the temple-bone, and then is diuided into two branches, the one running outward [Tab. 7. Fig. 13, f] through the eighth hole of the wedge bone into the cavity of the Nose: [Tab. 7. Fig. 15, F] the other inward, which is diuided into two, [Tab. 7. Fig. 13, uu] and after distributed into the *Dura meninx*; and this is called the second artery, though it arise out of the first.

The third artery [Tab. 7. Fig. 13, I] is the other branch of the inner trunke of the *Carotis*, much lesse then the first; getteth in at the first hole of the nowle-bone, [Tab. 4. Fig. 10, b] and so passeth into the *Sinus* of the *dura meninx*.

There is also one other artery called *Cervicalis* which is a sprout of the axillary artery, it perforateth the *dura meninx* in the side where it inuesteth the spinall marrow and entreth the Scull at the same large hole whereout the marrow issueth, and ascendeth vnto the place of the Glandule called *pituitaria* where it is diuided into two branches, which helpe to accomplish the *Plexus Choroides*.

Beside these veines and arteries, the *Sinus* of the *dura meninx* is also a vessell of the braine which



which we haue at large described before. It receiueth three veines, [Tab. 7. fig. 13, CDE] and two arteries [IK] which vnburthen themselues into it: and this *Sinus* according to his diuers course is distinguished into foure as you haue heard, which are larger then the veines that ascend vnto the Scull, but not round as they are, but rather like a triangle consisting of three ribs of an equall length and curued somewhat inward. From these do issue certaine passages like vnto veines, by which both sorts of blood Naturall and Vitall, is distributed into the substance of the braine as we haue said before.

The vse of
the veines.

The vse of the veines is three-fold, first to bring plentifull nourishment to the braine. The second, to bring a Natural influent spirit from the Liuer to nourish the ingenit Natural spirit of the braine.

The third, together with the Natural spirit to bring the Vegetable soule or power into the braine.

The vse of the
Arteries.

The vse of the arteries is to bring vitall spirits and facultie to cherish the vitall spirit of the braine, to ventilate the in-bred heate of the braine, to moue the blood in the veines which otherwise would stand and so putrifie: And finally to make the blood of the veines which is thicker heere then ordinary (as we haue already obserued) somewhat thinner that it might passe and repasse more freely.

And thus much shall suffice concerning the containing parts of the head both outward and inward, common and proper, with their appertinances the vessels. Now it is time we should come vnto the parts contained, which are the braine and the after-braine, with the spinall marrow and Nerues arising therefrom: and first of the braine it selfe.

CHAP. IX.

Of the Excellency, Scituation, Figure, Substance, and Temperament of the Braine.

A diuision of
the Head.

Being to vndertake the history of the braine, me thinkes we may make a diuision of those parts that belong vnto and fall vnder our sense into foure sorts. One sort of them that are about the braine as the containing parts already spoken of outward and inward, common and proper. Another sort of them that are within the braine as the substance thereof, the figure, the magnitude and the diuers parts which haue diuers names giuen them according to their different formes, of which we will heere and heereafter in-treate. A third sort of them that ascend vnto the braine, as the veines and arteries, of which wee spake somewhat in the former chapter, and shall do more if God permit in the booke of vessels. A fourth and last sort of them which issue from the braine, as the marrow of the backe or spine, the Nerues and the Animall spirit, of which also wee shall presently heereafter discourse: But to the purpose.

Aristotle.

Aristotle (in his 2. booke *de partibus Animalium* and the 7. chapter, and in the first booke of his History of Creatures, and the 16. chapter) saith, that all Creatures which haue blood, haue also a braine and none other, vnlesse it be somewhat proportionable as the *Polypus*.

This braine among the ancient *Greekes* had no proper name, but because of the scituation it was called *ἐγκεφαλον*, because it was contained ἐν τῇ κεφαλῇ in the head. Of the generation of it *Hippocrates* hath learnedly discoursed in his booke *de Carnibus*, to which wee referre the learned Reader; as also for the order of the generation thereof to *Aristotle* in his booke *de generatione Animalium* and the sixt Section.

The braine
the principall
part of the
whole body,
and why.

It is the principall part of the whole body which may be proued by the scituation, the figure, the defences it hath, and the vse of it. The scituation is in the highest part of the body as it were in a defenced Tower, that it might be better secured from outward iniuries.

The figure is round, which is the most noble figure of all the rest: for it was proportionable that the diuine part should haue the most perfect and absolute figure.

The defences
of the braine.

The defences of the braine are very many, the haire, the skinne and that the thickest of all the body, the fatte and fleshy Membrane, the *Pericranium*, the *Periostium*, a double tabled Scull and two Meninges or membranes, by all which it is of all sides defenced from violence, so that it cannot be hurt or offended but with extreame wrong. But neither the heart nor any other part is so provided for by Nature, wherefore it should seeme she made more store, as we say, of it then of all the rest.

The excellency
of the vse
of it.

In respect of the vse it will easily carry away the prize of Excellency; for the soule of

of man saith *Varolius*, being not tyed to any bodily instrument cannot apprehend those outward things which are without it selfe, vnlesse it be by the mediation of a corporeall organ, into which the *species* or formes of materiall things may be transmitted, by which afterward they may bee exhibited, and in which they may be apprehended and contemplated: euen as he that is shut vp in a roome, cannot see those things which are, or are acted without, vnlesse there be some Tralucēt body wherein the Images of those outward things may first be receiued and after represented to him that is within. Such an instrument is that which wee call *Commune sensorium* the common sence, for nothing can come into the vnderstanding vnlesse it be first in the sence.

Comparison.

Now this first or common sence according to *Plato* and *Galen* is the braine; (for *Aristotle* did but dreame that it was the heart) and they thought well. For not onely *Galen* but *Aristotle* himselfe did resolue, that that was the first *Sensorium* or common sence, which is the originall of sinewes. Nowe Anatomy teacheth vs that all the sinewes arise from the braine.

Arist. dreame.

The common sence is the braine.

Hence then it is manifest that the Braine is the seate of the Sensatiue Soule; for if a nerue which is directed vnto any part be obstructed, that part is deprived of sence and motion & so of the sensatiue Soule. If the originall or beginning of the spinall marrow be obstructed all the parts vnder the head do loose both sence and motion, when as yet the head inioyeth them both. But if the fourth ventricle of the Braine be obstructed, then not onely the whole bodie but the head it selfe looseth motion and sence, and is deprived of the sensatiue Soule.

Who then will deny that the Brayne is the most noble of all the members, seeing it is the seate of all the Animall faculties, Imagination, Reason or discourse & memory (wherefore *Aphrodiseus* called it *ὄργανον τῆς φρονήσεως* The Organ of wisdom) and the beginning or originall of sence and voluntary motion; and beside seeing from it doe vsue and on it do depend all the instruments of the senses of seeing, hearing, smelling, tasting, touching yea and speech also. And therefore *Plato* did worthily call it, because he could giue it no higher a stile, *The diuine Member*. For what the Heauen is in the worlde, the same in man is the Braine. The Heauen is the habitation of the supream Intelligence, that is, of God; and the Braine the seate of the Soule, that is, the *demi-God* of this little world.

Aphrodiseus.

Platoes.

Hence it was that *Homer* called it *ἱεραία*, that is the Heauen, because as from the Coelestiall influence all things below it are moued both in heauen and earth; so all the parts of the body haue sence and motion from the influence of the Braine.

Comparison.

Wherefore with *Galen* we determine that the Braine as well as the Heart is a principall part: not that wee thinke, as some doe, that the Braine is the Prince and King of the rest, no more then we thinke with *Aristotle* that the Heart is the most noble of all the parts. But we say that as the heart is of greatest & of most instant necessity for life, so the place of dignity belongeth to the Braine. *Columbus* giueth an elegant reason hereof taken from Generation.

The braine not the prince but a principall part.

The Liuer (saith he) is ingendred by the mediation and helpe of the vmbilicall veine, the heart by the mediation and helpe of the vmbilicall arteries, and these are ingendred by the vessels of the wombe: but the nerues which are the instruments of sence and motion doe immediatly arise out of the braine of the Infant.

Columbus, his reason.

The braine is commonly called *ἐγκεφαλος*. *Galen* in his Booke *de motu musculorum*, calleth it *κεφαλὴ ἐγκεφαλῆς* The marrow of the head, for a difference betweene it and the marrow of the backe which is called *ἐσχατὴς*, and the marrow of the bones from which it much differeth, because it is not dissolued by fire, nor consumed in hunger, nor contained in the skull to nourish it. Wherefore *Galen* in his 8. Booke *de vsu partium* and the 4. Chapter putteth a difference betweene it and the marrow of the bones, because this is fluxible and like vnto fat, neither couered with coates nor wouen with veines and arteries, neither hath any communion with the muscles and nerues, all which is contrary in the Braine.

The names of the braine.

Apollidorus thought that none of the Ancients had giuen any name to the Braine in any of their writings, and that therefore *Sophocles* called it *λευκὸν μυελόν*, the white marrow; imitating therein *Plato*, who when he would giue a name to the Brayne called it *κεφαλόν*, and True Loue the Grecians say is *ἐν τῷ ἀνωτέρω λευκὸν μυελόν*, euen at the uppermost marrow or at the Braine of the Soule, no doubt because they thought that the Soule was the Braine.

Sophocles

A greeke prouerbe.

It is scituate in the head as in a Castle most safe, because of the defences thereof before mentioned; as also because it is the highest place, & as it were the Tribunall or throne of

of

of her body. For as God who is the parent yea the Creator of the Vniuerse is sayd to haue his seate and throne in heauen: So the Braine which is the pallece of the soule was wiselie seated in the height of the body, partly also because of the eyes and eares, for their nernes being soft had neede also bee as short as might be, and therefore placed neere vnto the braine. Now aboute they must necessarily bee seated because they are the scout-watches of the Bodie to foresee and to heare of dangers before they come vpon vs.

Figure.

The Figure of the Braine is answerable to the Figure of the Scull, not that it is fashioned by the Scull, for if it had beene so, then the Scull should haue bin formed before the Braine. Againe (saith *Galen* in his 8. Booke of the vse of parts and the 12. chapter) they that say that the Braine is fashioned by the Scull doe not obserue that the Braine is manifestly separated from the *Dura Meninx*, and that the *Meninx* it selfe although it touch the scull yet it adhereth not vnto it. It expresseth indeede in the surface of it the forme of the cavitie of the scull, and when it is rightly formed it is round and a little longer then globous, because of the ventricles which were to be formed therein.

Forward it is somewhat narrower, backward broader, and on either side lightly depressed [Tab. 6, fig. 1. sheweth this] but in those that haue as wee say *Leisa principia*, that is, in Idots it is often otherwise fashioned as we haue said before. But in the Basis it is vnequall & full of variety because the scull hath there diuers dens and bosoms, especially at the wedge-bone [Tab. 14, Fig. 19, betweene A and the latter B] and the inward proceesse of the Temple-bones. [Tab. 15, Fig. 20, betweene H and N] But aboute all it swelleth out forward at the instruments of smelling, and produceth two teates as it were [Table 14, Fig. 19, CC] which are therefore commonly named *Mamillares processus*. But where it coucheth vpon the *Cerebellum* or after-braine it is smooth and more equall. [Tab. 14, Fig. 18, AA, BB.]

Magnitude.
Aristotle.

Concerning the magnitude; the braine of a man (saith *Aristotle* in his 2. Booke *de partibus Animalium* and the 7. chapter) in comparison and proportion with other creatures is the largest, so that the Braine of one man is more then of three Oxen, first because in a man there are many Animall functions which beasts haue not, and those that wee haue common with beasts are in vs much more perfect. For being in man the instrument and organ of reason, it was necessary it should containe yea and perfect also great plenty of spirits. Now many spirits cannot bee made but of much blood, and abundance of blood cannot be conteyned in a little body. Againe, it was fit that the braine should bee large, moist, thicke & glutinous that they might not by reason of their notable tenuity vanish away but passe into the whole body by proper and peculiar channels for them.

But the magnitude in length, breadth and thickenesse is so great as the capacity of the scull is able to containe, for together with his Membranes the Flegmaticke Glandule, and the vessels that ascend vnto it; it filleth all his compasse [Tab. 6, fig. 1, and 2. Table 9, fig. 3 and 4.] before and behind, and on either side, only leauing so much distance as may suffice for his *Diastole* and *Systole*. Finally, it is so great saith *Banhsine* that in our dissections we haue found it weigh foure or fve pounds; and *Archangelus* addeth fve pound and a halfe; for the larger a man is the greater and more weighty is his braine, yea children because of the waighe of their braine cannot of a long time carry their heads stedy vpon their shoulders.

Connexion.

It is knit by a common connexion of Veines, Arteries and Sinnewes with the rest of the parts, although more familiarly to the spinall marrow and the sinnewes, because they are produced heere from. Hence it is, that when the least or basest part of the body is pained the Braine also partaketh of the smart. As for supportation and strength it needed no assistance from the other parts because it is so strongly fortified and as it were intrenched within the scull.

Substance.
Archangelus.
Praxagoras.
Philosimus

The substance of the braine hath a double principle of which it is formed, the seede and the Mothers blood. *Archangelus* thinketh it hath no such principle, it may be hee is of the opinion of *Praxagoras* and *Philotimus* of whom *Galen* maketh mention in his 8. booke of the vse of parts and the 12. chapter, who thought that the braine was nothing else but a production or propagation of the spinall marrow, and that was the reason why it is foulded vp in so many convolutions and revolutions. But this is an idle speculation of a wandering Braine. We wil determine (as is said) that it hath a double principle, seede and blood, of which is generated a peculiar kinde of glandulous substance like whereunto there is none in the whole body, so that *Aristotle* exceeding well in his 2. Booke *de partibus Animalium* and the 7 chapter laide, that it was *sui generis* of his owne kinde, intimating thereby, that there was no other kinde in the whole body whereunto it might fitly bee referred. For because the in-

Aristotle

genit

genit functions of the Braine are peculiar vnto it alone as *Vesalius* hath well obserued, it was framed and fitted by Nature for the performance of these functions, of a peculiar substance and essentiall forme wherein the principall faculties of the soule, Iudgement, Imagination, Reason and Memory might reside, and which they might vse as their proper instrument, and on which the rest of the senses might depend.

It is white, soft and very moist. White by reason of his spermaticall matter, for it is made of the purest part of the seede furnished with abundance of spirits, as also that the Animall spirits therein contained should bee cleare and bright, not muddy or otherwise coloured. Yet is not all his substance perfectly white, for that which is neerer to the convolutions [tab. 9. fig. 4. tab. 10. fig. 5 E F] is somewhat nearer to an Ash colour, as it is also in the *Cerebellum*, the reason whereof some think to be because there are so many small veines disseminated through it. For as we thinke the *via lactea* or Milky Way in heauen is occasioned by an infinite number of small starres which to vs are inuisible, but yet do giue a brightness to that part of the sky; so though we cannot see how the veines do alter the colour in this place, yet seeing it is altered, it is very reasonable that the insensible membranes of the small veines giue that ashy colour vnto it. The rest of the Braine a little more inward is pure white [tab. 9. fig. 4. G H. tab. 10. fig. 4. G H. tab. 11. fig. 7. and 8. E E.]

It is soft, and softer (saith *Galen* in his 8. Book *de usu partium* and the sixt Chapter) then the *Cerebellum*, because it is the originall of the soft Nerves pertaining to the Organes of sense, but the *Cerebellum* is the originall of the hard Nerves commonly thought to bee the Nerves of motion. In Children the Brain is so soft that it is fluid. The reason of the softnes is because it is to receiue all the species or representations of the outward senses, as also of the imagination and vnderstanding. For vnlesse the alteration or impression that is made in any of the senses do proceede first from the Braine and after returne againe vnto it, the creature hath sense of nothing; which is proued by the example of such as are taken with the Apoplexie. Wherefore seeing sensation is a passion, it was requisite that the braine should be of such a substance as is fit to receiue the impressions of such things. Yet it behooued not it should be so soft as that the impressions made therein, should presently sink away and be obliterated, as it hapneth in water and other fluide bodies, but that it should haue with the softnes a kind of consistence or solidity, which solidity is so exquisitely mingled with the softnes, that the fire cannot melt it as it doeth fat or wax and such like. To conclude it is like the substance of a nerue, of which also his marrow is the originall, but a little softer. *Hippocrates* in his Book *de Glandulis* liketh it vnto a kernell, because as a kernell it is white and friable, and beside is of the same vse to the head that a glandule would be, drawing vp the exhalations of the lower parts which after vapor out by the Sutures of the skull.

The Temperament of the brayne is cold and moist, as we may easily with *Galen* in the 8. Booke of the *Vse of parts* conclude from the softnes and moistnes of his substance. Wherefore *Hippocrates* in his Booke *de Carnibus*, calleth it *μυρροειδὲς καὶ ὑγρὸν καὶ τὸ κολλώδες* the *Metropolis* or chiefe seate of cold and glutinous moisture. Glutinous to hold and containe the subtile Animall spirits which otherwise would soone vanish and decay; and cold that the part ordained for the exercise of reason and therefore fulfilled with hot spirits should not easily be set on fire or enflamed. For when the braine by any accident or distemper growes hot as we see in phreniticall patients, the motions thereof are furious and raging, and the sleep or none, or turbulent and vnquiet. And indeed the Head is very subiect (colde although it be by Nature) to hot distempers, partly because of the perpetuall motion thereof and of the spirits, partly by reason of the aboundant Veines and Arteries and great quantity of blood therein conteyned, and finally because whatsoever hot thing is in the body either Naturall or vnnaturall if it be inordinately moued flieth vp vnto the braine, or at least senderth hot vapors vnto it.

CHAP. XI.

Of the Substance and parts of the Braine.



As the Braine is the Originall and seate of all the Animall Faculties, so for the exercise of the same it hath diuerse and different parts cast into sundry moulds which we will now take view of according to Anatomical Method, alwayes remembring that

R r

Vesalius.

Why the brain is whyte.

Comparison.

Why soft.

Why not like to Fat.

Why it melteth not.

The temperament of the Braine.

The Reason thereof.

Why the brain hath diuerse parts.

that by the Braine we vnderstand whatsoeuer is conteyned within the Scull and compassed about by the hard and thin Membranes.

3: Parts.

The Braine therefore we deuide into three parts. For first it is parted into a fore-part and a hind-part by the *Dura meninx quadruplicated* or foure-foulded.

The forepart.

The forepart because it is the greater and most principall (for in it the Animall spirits are especially laboured) reteineth the name of the whole, and is properly called *Cerebrum*, or *ἐγκεφαλον*. The hinder part is much lesser, and is called by a diminutive word, *Cerebellum* we call it the After-braine. *Herophilus* as *Galen* witnesseth in his 8. Booke of the *Vse of parts*, and the 11. Chapter; calleth it *παρεγκεφαλον*.

Subdiuided.

Againe the forepart or the Braine, by the *dura meninx* duplicated and resembling a Mowers Sythe, is parted in the top throughout his whole length into two equall parts, one right, another left. [tab. 8. fig. 2. from A to A. tab. 9. fig. 3. from N to R.]

This partition reacheth altogether to the Center of the Braine and stayeth at that body which we call *Corpus callosum*. [tab. 9. fig. 3. at L L.] And this is the reason why alwayes the same part of the head is not pained, but sometimes one part sometimes another, sometimes the whole head.

Some, sayth *Laurentius*, haue dreamed that the braine is deuided quite through, but they are much deceiued, for the callous body vnitheth the parts together. As for the after-braine though it bee not vnited to the braine, yet is it in two places continued with the beginning of the spinall marrow, and the same marrow by two originalles ioyned vnto the Braine.

The vse of this diuision.
Out of *Vesalius*.

The vse of the diuision of the Braine is first out of *Vesalius* and *Archangelus*, that the brain might bee better nourished, for by this meanes the thinne membrane together with the vessels there-through conuayed, doe insinuate themselves deeper into the substance thereof: for without this partition and those deep conuolutions which we see in it when it is cut it could not haue beene nourished.

Out of *Laurentius*.

The second vse we will adde out of *Laurentius*, to wit, beside the nourishment for the better motion of the same; for as water is not so easily mooued where it is deep as where it is shallow; so if the braine had beene one entire massie substance, it would not so willingly and gladly as we say, haue risen and falne in the *Systole* and *Diastole*.

Out of *Banbini*.

The vse of this diuision out of *Banbini* is more expresse: for the safe conduct of the *Sinus* or pipes of the hard *meninx* mentioned in the seauenth Chapter, from whence doe issue small furcles of vessels to conuay nourishment into the conuolutions of the braine.

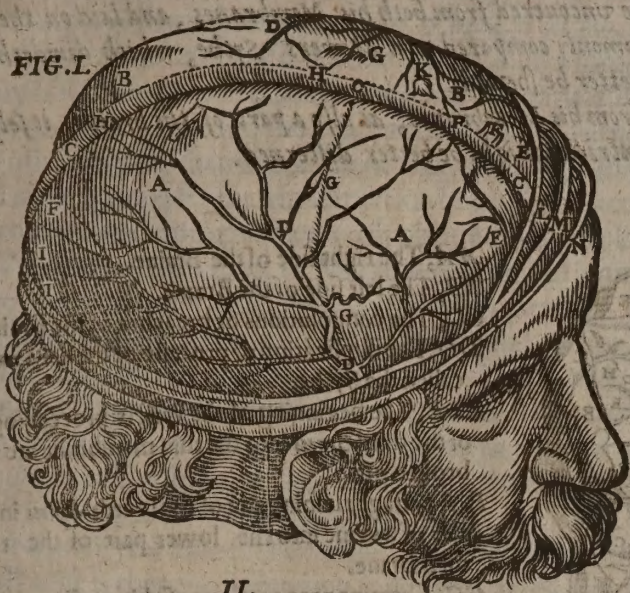
For because the quantity of the braine is very great, through which the *Capillary* vessels were to be disperfed for his nourishment; if the vessels themselves so small as they are veines & arteries, should haue passed from the backpart to the forepart, from the right side to the left or on the contrary, they would in so long a iourney through so soft and clammy a body haue been in danger of breaking, wherfore the braine was diuided into three parts; betweene which diuisions there runne foure *Sinus* or pipes of the hard *meninx* into which the internall Iugular veines and the sleepey arteries called *Carotides* ascending from the *Basis* of the Nowle of the head doe powre their bloud and spirits; which is conuayed on either hand into the after-braine and the braine, by certaine branches deriued out of height and depth and the sides of those pipes as we sayd ere-while, especially out of the third *Sinus*, into the left, and right parts of the braine.

Finally, because soft bodies when they are great doe easily fall into themselves, therefore the brain was diuided into two parts that it might the better consist, as also that the instruments and organs which were led vnto it might not be shuffed together: and so much of the vses of the diuision of the braine.

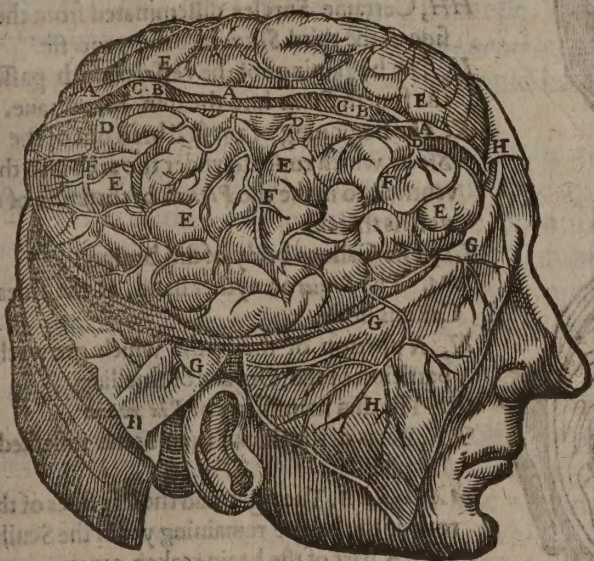
The conuolutions of the braine.

Now the outward face of the braine which we sayd was of an Ash-colour rather then white, hath many and diuers orbicular circumuolutions and circular ruts, which the Ancients sayeth *Vesalius* and those after him haue excellently compared to the gired windings of the guts when the kell is taken off. [tab. 8. fig. 2. tab. 9. fig. 3. c c c.] *Galen* in his 8. Booke of the *Vse of parts* and the 13. Chapter calleth this *variā compositionem*, and *Vesalius* himselfe compareth them to the Clouds that a Painter makes in the rooffe of a house. Some of these snailing paths are deeper, others do not pierce so deep into the substance of the braine [tab. 9. fig. 4. DD] & therefore are called *pars varicosa cerebri*, the knotted or embossed part of the braine by *Laurentius*. They are inuested with the *pia mater* or thin *meninx* (and when that is taken off may be better discerned) which not only compasseth them and containeth them

in



II.



in their superficies, but also with the in many places diueth into the depth of the braine.

Some are of opinion that these conuolutions are only framed of necessity, but haue no vse at all: but we with *Galen* do determine that their vse is to secure the vessels, that going together with the *Pia mater* they might cary vnto the brain nourishment and life, and not be in danger of breaking in the perpetual motion and agitation of the braine. For the *Pia mater* being a thin and fine membrane and simple (not double that the vessels might run betwixt the duplication thereof) needed these winding Meanders to secure the vessels.

But if the superficies or surface of the braine had beene smooth & equall & the vessels had run along about the circumference thereof, they had beene subiect to breaking, especially in the *Diafoe* or Eleuation & in the full of the Moone, at which time the braine by reason of the humidity thereof so swelleth that the vessels must needs haue borne vpon the scull. Beside, the vessels would not haue beene sufficient to haue irrigated and watered the huge

and vast body and bulke of the braine if they had onely runne ouer the surface thereof. *Platerus* addeth further; because the venall and arteriall blood arising to the braine is not yet fit for the vse thereof, it was necessary it should runne in proper vessels, and that into the inmost substance of his marrow where the inbred power of the braine might labour it and purge it from those excrements which are gathered and heaped vp in these Conuolutions, that being so prepared the braine might apply it as vnto his nourishment and also for the procreation of Animall spirits.

Another vse of the Conuolutions remembred also beside *Bauhine* by *Archangelus* and *Laurentius* is, for the recreation of the spirits and the blood contained in those vessels. For if there had not beene these gyrations in the substance of the braine, the vessels especially in the full of the Moone would haue beene so closely compassed by the Scull, that their motion would haue beene intercepted, and the spirit being compressed would haue beene suffocated or strangled, and the heate for want of ventilation extinguished.

Erasistratus thought that the braine of a man had more Conuolutions then the braines of other Creatures because of his reasonable soule; which conceite of his *Bauhine*, *Archangelus* and *Laurentius* do sweetly smile at, when they behold the same conuolutions in the braine of an Asse, the most dull and stupid of all other creatures. Beside we learne out of *Galen* in his 8. Booke of the *Vse of parts* and the 13. Chapter, that vnderstanding followeth not the variety of the composition but the good temper and disposition of that body which vnderstandeth. *Laurentius* and *Columbus* thinke that Nature by these conuolutions provided for the lightnesse of the braine, and to make it more prompt and ready for motion. But *Archangelus* taxeth them for it. As if (saith he) Nature could not haue made it of a lighter

Their vses.

Galen.

Platerus.

Another vse:
out of *Bauhine*, *Archangelus*, *Laurentius*.

Erasistratus
his conceite
disproued.

Archangelus
taxeth *Columbus*
and *Laurentius*.

Table 9. Figure 3. sheweth the braine uncoverd from both his Membranes, and laid on the one side, that the proesse or duplication commonly compared to a Mowers Sythe, which diuideth the Braine; as also the Callous body might better be shewed.

Figure 4. sheweth the Braine freed from his Membranes, as also a part of the braines it selfe is taken away that the marrow and the ventricles might be better discerned.

TABVLA IX.

FIG. III.



FIG. IV.



- AA, The right side of the Braine.
 BB, The left side of the Braine.
 CC, The convolutions or breaches of the Braine.
 DD, The duplication or proesse of the *dura mater* called the Sythe.
 EEE, The beginning of the vessels proceeding out of the third *Sinus* into the thin membrane are heere broken off.
 F, A passage running out of the fourth *Sinus* in manner of a veine into the lower part of the thicke membrane.
 GG, Certaine propagations of this passage running vpward into the same membrane.
 HH, Certaine Surcles disseminated from the lower side of the third *Sinus* into the proesse.
 II, The beginnings of the vessels which passe from the fourth *Sinus* into the thin Membrane.
 K, The beginning of a vessell bred out of the fourth *Sinus*, which runneth vnder the arch into the third ventricle to make the *Plexus* or thrumbe of crisped vessels therein.
 LL, The Callous body of the braine.
 MM, The *Sinus* on eyther hand, at the sides of the Callous body.
 N, A portion of the Sythe which groweth to the partition of the Organe of smelling.
 OO, The thin membrane or *Pia mater*.
 PP, Parts of the thicke membrane reflected.

Fig. 4.

- AAA, BBB, The right and the left sides of the marrow of the braine remaining yet in the Scull.
 CCC, A part of the braine taken away.
 DDD, Divisions or lines from the breaches of the braine.
 EEEE, The Shel or Barke of the braine compassing his marrow.
 GG, HH, The marrow of the braine which when it is pressed is full of red points or small drops or graines.

III, The Callous body freed on either side from the substance of the braine. KK, A part of the Callous body. LL, MM, The right and the left ventricle of the braine. NN, a part of the vpper side of the left ventricle. OO, The complication or thrumbe of vessels called *Plexus Choroideus*. PP, Small veines growing to the ventricles. Q, Other vessels running from the same veines into the *Pia mater* or thin membrane.

matter if that had beene behouuefull, or a little lesse and so lighter? Beside wee see that the heart is of a most solid and firme substance without any of these gyrations, and yet it mooueth in *Systole* and *Diastole* very freely. *Vesalius* and *Laurentius* adde that they were also ordained for the supportation of the soft substance of the braine that it might equally be supported and not sway too much to either side. And thus much for the vses of these convolutions as also for the vpper part of the substance of the braine.

Now the internall or inward superficies hath in it diuers parts and impressions because of the many vses for which Nature hath ordained it. The substance therefore of the Braine is by *Archangelus* diuided into the Braine and the Marrow. The Braine he calleth that ash-coloured part which compasseth the rest, whereby he meaneth the marrow: we will say it may be diuided into the Shell and the Kernell. The Shell is that Ash-coloured body [tab. 9 fig. 4, tab. 10. fig. 5, EF] which compasseth immediately the kernel or marrow. The kernel

Another vse:
out of *Vesalius*
& *Laurentius*.

The inward
part of the
Braine.

The Shell and
the Kernell.

or marrow is that
which is hid within
the body is within the
humor. Wherefore
the other white
and more compact
circumference dif
Wherefore the
there are two part
ed downe to the
bodies also the the
man new daine an
very moist and ext
fuments of smell
to if the body haue
Now if you di
small vessels there
there will start ou
Epporates in his
whole body vnto the
in the quest of wh
their curious how
Aristotele in the fir
is altogether witho
nath any veine with
too neare vnto him
neuer found with
neticall and such
carry no resemb
the one the Gen
the Eye of Anato
that *Hippocrates* ha
Reader: but I leaue
priuy searches, one
rings of *Hippocrates*
diligent and studio
the writers in the w
fcke: we returne re
If you lightly wi
a notable bignesse
the braine, there w
the braine [tab. 9, 10]
lyeth *Archangelus*
whiter also then the
because it is harder
but much whiter, is
nifications and the
braine: wherefore a
are hollowe
elected to receiue
braine, and to send
But the vse of the c
the braine which li
conioyned, as also to
holdeth 9. 11. 12. &
figure or *Hippoc*
partition it also int
comprelle the thin

or marrow is that white body [*tab. 9. fig. 4, G H, tab. 10. fig. 5, G H, tab. 11. fig. 7, and 8, E E*] which is hid within the ash-coloured body and is somewhat more solide; for this white body is within the ash-coloured body as the cristalline humour of the eye is in the glassie humor. Wherefore the shell differeth from the kernell first in color, the one ash-coloured the other white; then in consistence for the shell is softer the kernell a little harder firmer and more compact; then in scituation because the kernell is in the midst the shell in the circumference distinguished with oblique and crooked lines.

Wherefore the kernel or Marrow is the middle and white body of the braine, of which there are two parts; one containd within the skull, the other falling out of it and lengthned downe to the great hole of the *occiput* and ending in the spine of the backe. These two bodies also, the shell and the kernel, may actually be separated if we haue the head of a sound man new flaine and presently with dexterity dissected; otherwise both of them will grow very moyst and extreame soft, as it hapneth to the mammillary processes which are the instruments of smelling, which in a fresh body may easily bee parted at the marrow, but not so if the body haue beene dead any time.

Now if you dissect the braine ouerthwart, about the midst of it you shall perceiue small vessels therein descending to his ventricles, and if the marrowey substance be pressed there will start out of it many drops or graines of blood, which make me remember that of *Hippocrates* in his Booke of the falling sicknesse. *Many and small veines doe ascend out of the whole body vnto the braine, and especially two notable, one from the Liver another from the Spleene:* in the quest of which (if any such be) I would haue the great Anatomistes spend some of their curious howres.

Aristotle in the first Booke of his History and the 16. Chapter is of opinion, that the braine is altogether without blood (that we finde false by manifest experience) neither containeth any veine within it, but that onely the Meninx about it hath veines. *Vesalius* leaneth too neare vnto him, for these are his words: The substance of the Braine and After-braine is neuer found with any veines therein, although you shall find in those that dy mad or phreneticall and such as are hanged, certaine red and bloody specks or spots; but these spottes carry no resemblance of a veine at all. Notwithstanding, though these two great Clarkes, the one the Genius of Nature and the very President of her priuy Councell and the other the Eye of Anatomie, haue thus resolved vpon the case: I presume there is something in that *Hippocrates* hath so particularly related, whose vse is not so peremptorily to seduce his Reader: but I leaue the disquisition to those whose meanes and oportunities are fit for such priuy searches, onely adding this one thing which I confidently auouch, that the onely writings of *Hippocrates* after so many ages and Commentaries past, haue in these dayes led the diligent and studious Readers into the knowledge of more mysteries of our Art, then all the writers in the world beside; for hee alone is a boundlesse and bottomles ocean of Physicke: we returne to our history.

If you lightly with your fingers deuide the sides of the braine till you come to a veine of a notable bignesse running through his length and sprinckling branches on either hand into the braine, there will offer it selfe vnto your view a body placed exactly in the midst of the braine [*tab. 9. fig. 3. L M*] gibbous or rising somewhat round [*tab. 9. fig. 3. L*] in which sayeth *Archangelus* the two first ventricles are excauated, long, narrow, smooth and equall, whiter also then the vpper part as being made of the marrow or inward substance, which because it is harder and somewhat like a callous or hardnesse of the skinne gotten by labour but much whiter, is called *τὸ λεγόμενον*, by *Galen* in the 9. Booke of his Anatomicall Administrations and the third Chapter, that is, *A callous body*. It is a part continued with the braine, wherefore at the sides thereof in his length two *Sinus* or ventricles [*table 9, figure 3. at M*] are hollowed in the marrow of the braine like deep lines or hollow pipes, which are esteemed to receiue the defluxion, of rheume, or phlegme out of the vpper parts of the braine, and to send it forward by the gibbous superficies of the callous body vnto the nose. But the vse of the callous body vndoubtedly is by his vpper part to sustaine the waight of the braine which lieth vpon it, and that by this mediation both parts of the braine might be conioyned, as also to make a distinction or hedge which they call *septum* [*tab. 10. fig. 5, R R* holdeth vp *T T, X X* and *X T* lift up *S T V*, least *A A A* in the sixt figure should presse *H I* in the same figure or *H* in the 7, and 8. figures of the 11. Tab.] which separateth the two ventricles; which partition it also sustaineth and lifteth vp the arch called *Fornix*, least falling downe it should compress the third ventricle.

The kernell or marrow.

Note this.

A difficult place in *Hippo.*

Aristotle.

Vesalius.

Commendation of *Hippo.*

The *Corpus Callosum.*

Archangelus

The vse of it.

A story out of
Bauhine.

In this place sayth *Bauhine*, in the year 1582. I found a scirrhus or hard tumor in the noble Baron *Bonacurtius* (who lay a long time in a manner Apoplectical or astonished) when we opened his head after his death.

When we haue cut away the substance of the braine on either hand as deepe as vnto the Callous body, before we list it vp, we must marke the *septum* or partition of the two first ventricles.

The *septum*
lucidum.

This *septum* or partition [*tab. 10. fig. 5. at R R R reflected backward*] in the vpper part groweth to the Callous body and is perfectly vnited thereto (wherefore *Vesalius* calleth it the inner or lower *superficies* of that callous body) but below it groweth to the place of the Arch or *Fornix*, so that it standeth in the middest betweene the callous body and the Arch. This *septum* before it be stretched is loose and rugous and doeth not shine, neither can you perceiue how it is continued with those bodies of the *Callus* and the Arch; but drawe it vp so high till it be stretched (and take heed it breake not for it is but thinne) and then if you put a waxe candle to one side of it you shall perceiue the brightnesse of the light through it as if it were through a glasse. *Vesalius* compares it to the host in the Masse, which being a thinne wafer and a little wet, you may see a dull light through it; or say it is like a sliuer of the Muscouy glasse whereof we vse to make Lanthorns, or the horne of a lantorne it selfe. Whereupon *Columbus*, *Archangelus* and *Laurentius* haue called it *speculum*, *speculum lucidum*, *septum lucidum* and *lapis specularis*, the Looking-glasse. *Galen* giueth it a name from his vse in his 9. Booke *De Anatomicis Administrationi*, the first, the third and the fourth Chapters, calling it διαφραγμα των προσθιων κελων, The partition of the foremost ventricles, because the inner lips of the ventricles are hereby distinguished; wherefore you cannot aright perceiue it vnlesse both the ventricles be layd open, and if it be neuer so little too much stretched it easily breaketh, because it is so very thinne and subtile, yet cannot it be manifestly seene vnlesse it be lifted vp.

Diuerly com-
pared.

The names of
it.

The substance
of it.
Galen and
Vesalius.
Columbus &
Archangelus.

An Anatomist therefore in these curious things had neede to haue a fine and a dainty hand and at command. This partition is of the same substance (sayth *Galen* in the Booke before named and the third Chapter, and after him *Vesalius*) with the braine, but thinner, and in respect of his tenuity as it were the substance of the braine drawn out into a membrane. *Columbus* and *Archangelus* thinke it is nothing else then the *pia mater* in this place duplicated; but *Laurentius* and *Bauhine* agree with *Galen*. Yet though it bee thinne it is not simple, and it hath in the middest a little rising like a line [*table 10. figure 5. r*] which line bearing downward is by degrees lessened and becommeth the partition of the ventricle. [*table 10. fig. 5, the lower part of the septum at x x, the vpper at T.*]

These ventricles beeing taken away to the middest of their substance, wee meete with foure swelling particles: two before, about which is the Basis of the ventricles, two on the backside making the Arch or *Fornix*, of which we will entreate in the next Chapter.

CHAP. XI.

Of the ventricles of the Braine, the Arch, and the Plexus Choroides.

The ventricles
of the braine.

Although the Cavity which is in the Braine be continued quite through, yet because according to the forme of the Braine and the vse it is diuerly formed, so that one part is more dilated another more angustated or contracted; therefore the Anatomists haue diuided it into certaine places, and the larger of them they call ventricles, the narrower they call *meatus* or passages. The ventricles called by *Galen* κελιας, the Ancients and many of the new writers also following therein *Herophylus* haue reckoned foure. In the Braine three; two forward a right and a left, and the third in the middest. The fourth they make common to the after-braine and spinall marrow.

The first two of these (called by *Archangelus* the *Superior* because they hang ouer the other; by *Galen* in his 8. Booke of the *Vse of parts* the 10, 11, and 12. Chapters and diuers other places, the *Anterior* ventricles) are cut out of the marrow of the braine and are the largest of all the rest, because (saith *Laurentius*) they containe a crasse spirit or rather abundance of phlegme. They are on either side one, the right on the right hand and the left on the left, alike each to other in scituation, forme, magnitude and vse. They are scituate length-wise in the marrow of the braine in the very middest thereof. [*tab. 9. fig. 4. table 10. fig.*

fig. 5, L. fig. 6, the right is noted with D, but the left in the 9. tab. and the 4. fig. and the 10. tab. and first fig. at M, in the 6. figure at E] whether you respect the length or the depth of it. In their fore and hinder parts they are broader and more disioyned, in the midst lesse where they are onely divided by that thin partition we spake of in the former Chapter. [tab. 10, fig. 5. XXX] They runne obliquely or semicircularly saith *Archangelus*, [tab. 9. fig. 4, from L to M] for beginning about the temples where the marrow begins, they are by little and little curved toward the center of the marrow, and at the Region of the Eares they are bent againe, and so seeme to make two Semicircles. They are long, winding and somewhat large. Their forepart is blunt and round [table 9. fig. 4, and tab. 10. figure 5, L and the lower M] and in their inside they sinke downe vnto the third ventricle, [tab. 10. fig. 5, vnder STV and in the 6. fig. at H and I, the eleuenth table and the 7. fig. at H] whereupon some who have not diligently followed their curued passage haue thought that beside these two there are other two ventricles in the forepart of the braine, and so haue made vp the number of sixe ventricles; but we esteeme them to be portions of these vpper, for they are indeed larger then vsually they are esteemed. Backward also they are obtuse and round, [tab. 9. fig. 4, the vpper L and M] and do descend by degrees downward into the substance of the braine, and forward are straightened like the small end of a horne, and so creepe on to the mammillary proccesses and the ingresse of the opticke Nerues [tab. 11, figure 7, and 8. FG] and the sleepey arteries. Their vpper face is lined with a waterish moysture, and they are often found full thereof. Their vpper part [tab. 9. fig. 4, from L to L and from N to N] according to the length of the braine is smooth and æquall; the lower part is vnæquall, [tab. 10. fig. 6, R or S] because of the hollownesse prepared to receiue the defluxion of the phlegme; which hollownesse creepeth obliquely out of the backpart of the ventricles forward into their common cavity. For these two ventricles, as we shall say by and by, do determine into a common cavity. *Galen* and the ancients after him do write that the superficies of the first three ventricles are as the braine couered with the *Pia mater*. *Vesalius* denyeth it and addeth a reason: for, saith he, if the ventricles were lined within, the Membranes would hinder the substance of the braine from working the matter conueyed into them into Animall spirits. But *Columbus* and *Archangelus* side with *Galen* against him, and *Archangelus* thinketh that the *septum lucidum* is made of the duplication of the *Pia mater* after it hath inuested these ventricles. Wee leaue this to be farther scanned by the curious Dissectors: sure wee are that that which is called *Plexus Choroides* lyeth vpon them, from whence small veines [table 9. fig. 4, PP. tab. 10. fig. 5, PP. fig. 6, OO] are deriued which grow in the forepart to their substance, like vnto those which runne through the coate of the eye called *Tunica Adnata* or the white of the eye. *Archangelus* is of opinion that the *Pia mater* being it selfe of exquisite sense may by meanes of these small veines suffer inflammation, whence come those deepe paines which are sometimes felt in the Center of the braine. And indeed *Galen* maketh expresse mention both of the *Pia mater* compassing their cavity as we haue saide before, as also of these veines which insinuate themselues into the ventricles in the second and third Chapters of the 9. Booke of his Anatomical Administrations: so that *Archangelus* doeth but gather the conclusions out of *Galen*s præmisses.

It behooued sayeth *Galen* in the 8. Booke of the *Vse of Parts* and the 10. Chapter, that there should bee two of these ventricles, (because the Braine and euery organe of sense is double; for the braine is the first and most common cause of all those double organs) that if one of them be violated, the other might serue the turne; and this hee prooueth by an instance of a young man of *Smyrna*, who was wounded into one of these ventricles and yet escaped: but sayth he, if both of them had beene wounded he could not haue liued a moment of time.

Vesalius (as he is an importunate aduersary of *Galen*s, the lesse his thanke) reprobeth him for this, alledging that though the braine be parted into two, yet it is againe vnited before the ventricles are formed therein; and to say trueth it is hard to conceiue how one ventricle should bee wounded and the other not violated, considering the thinnesse of the membrane or partition that parteth them, and beside the common cavity whereinto they both determine; but experience often assureth vs of that which meere Reason and discourse will not allow of or subscribe vnto.

The vse of these ventricles is according to *Galen* in his eight Booke of the *Vse of Parts* Chap. 10. and 11. that of the ayre which we draw in conuayed into the brain by the organs of smelling & of the vital spirit ascending from the heart by the sleepey arteries, the Animal

Their Figure.

The water in them.

Whether they be lined with the *Pia mater*. *Vesalius* against *Galen*.

The causes of deepe paines in the head.

Why two ventricles out of *Galen*.

A story by him cited.

Vesalius oppugneeth him not without some reason.

The vses of these ventricles. *Galen*.

spi-

*Archangelus.
Laurentius.*

*Archangelus
his other vſes.*

Bauhine.

*A paſſage to
be obſerued.*

*Galen explain-
ed.*

*The 3. ventri-
cle.*

Galen.

*The forme of
it after Galen.*

*The two paſ-
ſages thereof*

The firſt

ſpirits prepared before in *plexu choroide* might in thoſe ventricles bee perfected, but how perfected? *Vesalius* thinketh by the particular ſubſtance and forme of the Braine. *Archangelus* thinketh they haue no ſuch uſe or power as to make Animall ſpirits. *Laurentius* ſayth that they ſerue for the inſpiration and expiration of the Braine, to receiue ſmells and to prepare the Animall ſpirits, and to containe them as it were in a ſtore-houſe yet not perfectly accompliſhed but inchoated onely. *Archangelus* ſubſcribeth vnto this and addeth moreouer, that the ayre drawne through the noſe and ſpongy bone into the ventricles, is laboured and prepared for the nourishment and refection of the Animall ſpirits, as the ayre is prepared in the Lungs for the refrigeration and recreation of the vitall ſpirits. Another uſe ſayeth he of them is (but that onely a ſecundary uſe) to ſerue for wayes whereby the excrements of the braine may be purged. Neither ſayth he, is there cauſe why we ſhould wonder that the ſame ventricles ſhould holde the Animall ſpirits and ſerue alſo for the ablegation of excrements, ſeeing we know that Nature hath ordained the Noſe firſt and primarily to be a meanes of ſmelling, and ſecondarily to call out the phlegme out of the braine and auoide the ſame.

We ſayeth *Bauhine* thinke, they ſerue to gather the excrements which are ſeparated in the nourishment of the Braine, the phlegme (for example) there engendred, and by their common paſſage to ſend it into the Tunnell called *Infundibulum* to bee conuayed away by the throat.

Archangelus in this place maketh mention of a paſſage which is (ſayth he) in the middeſt vnder the mammillary proceſſes & hath a double iſſue, one directly into the ventricles we ſpeake of, the other into the pallate and ſo into the Lungs. This paſſage is knowne but to a few, neither can it be found but in a ſound Braine when the man commeth to a ſudden and vnlooked for end and is preſently diſſected; for the parts of the braine that are about this paſſage do in a ſhort time ſo fall and cloſe together that the paſſage is cleane obliterated.

Hence *Galen* in his 8. Booke of the *Uſe of parts* and the 10. Chapter ſayed, that the ayre we breath in by our noſes paſſeth vnto the heart, but a part of it getteth into the ventricles where it is prepared and made the nourishment of the Animall ſpirits. *Columbus* aſcribeth the finding out of this paſſage to himſelfe, but *Archangelus* taxeth him therefore. And ſo much of the two firſt ventricles.

The third ventricle followeth, which is nothing elſe but the concurrence or meeting of the two former lengthned out ſomewhat backward. For the two former ventricles in their lower part vnder the Arch [*tab. 10, fig. 5. STV*] [*fig. 6. AAA*] do meete together in one place and there determine, being in their neather parts like a narrow path which runneth out backward a pretty length into the hindmoſt ventricle. This is called by *Galen* in his 8. Booke of the *Uſe of parts* and the 12. Chapter, the common cauity or common place of the forward ventricles; [*tab. 10, fig. 6, vnder H 1, tab. 11, fig. 7, and 8. H*] by others who doe deny the third ventricle it is called the perforation of the two former ventricles: others call it the third ventricle or the middle ventricle, becauſe it is in the middeſt of the braine, yea and in the very Center of the marrow betwixt the two forward ventricles and the fourth.

This at the firſt ſight is like a long ſlit or cauity, [*Tab. 11. fig. 7, and 8. H*] but more backward it becommeth larger, and is diſcerned, part of it when the arch is drawne a little backward, part of it when the Teſticles and the Buttocks of the braine are diuided in the midſt. It tendeth directly from the forward ventricles vnder the arch, the teſticles and the buttocks, [*Tab. 12, Fig. 10, from I to K*] toward the fourth ventricle [*Tab. 12, Fig. 10, K ſheweth the end of it.*] And this is *Galen's* delineation of his paſſage in his 8. Booke of the *Uſe of parts* and the 11. Chapter, whereunto *Vesalius*, *Platerus*, *Archangelus* and *Laurentius* do ſubſcribe, but *Columbus* maketh it ſhorter and ſayth it endeth at the backward paſſage neare to the *Glandula pinealis*. The figure of it ſayeth *Archangelus* is vncertaine becauſe there are many eminencies or inequalities in it.

This third ventricle hath two paſſages, of both which *Galen* maketh mention in his 9. Booke of Anatomicall Adminiſtrations and the fourth Chapter, the one he calleth the vpper hole or the Tunnell, the other the great hole of the third ventricle, wee according to *Bauhine* will deſcribe them thus.

The one [*Tab. 11, figure 7, and 8. I*] proceedeth out of the middeſt of the ventricle and is reaſonable large: it is caued in the ſubſtance of the braine and runneth directly downward

toward the *Bafon* which receiveth the phlegme at the Basis of the braine, and by it the phlegme of the two forward ventricles doth descend.

The other passage [*tab. 11, fig. 7, and 8, K*] which is the more backward (*Laurentius* addeth the larger also) is not round in his originall although it be a part of the third ventricle which is round. *Galen* in the 9. Booke of his Anatomicall Administrations and the 5. Chapter, thinketh that it hath a peculiar coate like that of the *Pia mater* wherewith it is lyned. It runneth vnder the Buttocks [*tab. 11, fig. 7, MN, fig. 8, NOPQ, tab. 12, fig. 19, DEFG*] and the Testicles into the fourth ventricle about the beginning of the spinall marrow. Out of the lower and forward angle of this passage, as soone as it is gotten vnder the testicles, there issueth another passage, [*tab. 11, fig. 8, neare to K*] farre narrower then the former, which passing sliely forward through the substance of the braine, sinketh downward and determineth in the end [*table 11, fig. 1*] of the first passage; out of both which ariseth an orifice [*tab. 15, fig. 20, D*] which endeth in the *Bafon*, and leadeth the phlegme out of the third ventricle. This *Vesalius* taxeth *Galen* for pretermittting, in the place next above named. Now whereas at the second passage there appeareth a certaine slitte or cleft, *Columbus* will needs liken the same vnto the lap or priuity of a woman.

The vse of the third ventricle is to be a receptacle of the Animall spirit, which also is by Nature so quainly formed (for *Archangelus* referreth all those resemblances of the Arch, the buttocks, the testicles, the fundament, the womans lap and the yard vnto the third ventricle) that it driueth them into the fourth ventricle.

About this third ventricle lyeth the *Fornix* or Arch called *καμάριον καὶ ἀλλοειδές*, because in forme and vse it resemblenth a crosse vault or arch. *Columbus* calleth it *Corpus cameratum*. The vaulted body, which (saith he) is supported with 3. pillars. This arch is but one and lyeth vnder the Callous body almost in the middle of the braine but a little backward, and swelleth equally out of both sides thereof: for it is common to both sides of the braine. It groweth out of the backe part of the two vpper ventricles [*tab. 9, fig. 4, the vpper L M. tab. 10, fig. 5, ST, fig. 6, BC*] where they bow forward. Whilest it is containd within the brain it is a long and callous body, yet broader toward the back-part, but as it creepeth forward it groweth sharpe to his very end, [*tab. 10, fig. 5, from ST to V, fig. 6, from BC to the vpper A.*] At that forward sharpe end [*tab. 10, fig. 6, at P*] it is againe ioyned to the substance of the braine as also to the callous body; but in the middest and in the rest of his bredth it is free and at liberty [*tab. 10, fig. 5, XX.*]

The figure of it is Triangular but consisting of vnequall sides, so sayth *Galen* in his eight Book of the *Vse of parts* and the 11. Chapter. *Vesalius* and *Laurentius* call it *semicircular*, or rather like a bridge whose backpart standeth vpon two knees, the forward vpon one. For first in the backpart it reacheth from one of the ventricles ouer to the other, and that side is short [*tab. 10, fig. 5, from S to T, and fig. 6, from B to D.*] The two other sides are equall and somewhat longer, reaching from the backpart to the forepart [*tab. 10, fig. 5, from S to V, and from T to V, fig. 6, from B to the vpper A, and from C to the vpper A*] so that backward it hath two Arches and forward one, and standeth like a threefooted stoole vpon the braine.

The substance of it is like the substance of the ventricles but somewhat whiter and harder, like the substance of the callous body. It is no where compassed with the *pia mater*, and in the bottome where it archeth ouer the ventricle, it is free and at liberty not tyed to any of the adjacent parts. [*tab. 10, fig. 6, A A A.*] In the sides where it respecteth the two forward ventricles [*tab. 10, fig. 5, at L M.*] it is supported, backward with two props and foreward with one; the superficies of it is smooth and moystned with a waterish humor.

On the outside neare the originall it is gibbous, embowed [*tab. 10, fig. 5, ST*] or convex, and in the originall orbicular or round, that without payne (sayth *Galen* in the 8. *de vsu partium* and the 11.) or disease it might sustain the waight of the braine lying vpon it, that the common passage or third ventricle vpon which it coucheth, might be kept open and large and not compressed, because vnder it the two first ventricles do meete.

In the length of it it swelleth a little in the middest like a broade line [*tab. 10, fig. 5, XX*] by which it is continued with the partition of the ventricle called *septum lucidum*.

Within it is hollow [*table 10, fig. 6, A A*] as well for the free passage of the spirits, as also that the vessell [*table 10, figure 6, HI, table 11, figure 7, V, arising from T*] arising out of the fourth *Sinus* of the *Dura mater* and diuided into the two forward ventricles, might passe vnder it and not be pressed by the substance of the braine hanging ouer it. And thus much of the Arch.

Second.

Another passage.

Vesalius taxeth *Galen*.

The vse of the 3. ventricle.

The *Fornix* or arch.

His Names.

And delineation.

His Figure, *Galen*.

Substance.

The

Table 10. Figure 5. sheweth the same that the former Table did, saving that the Callous body in the foreside separated from the Braine and reflected backward, and torne from that partition which distinguisheth the ventricles, is heere more manifestly to be perceived, together with the Fornix or Arch of the Braine.

Figure 6. sheweth the Arch loosned on the foreside and drawne backward, that the lower part and the vessels might better be seene.

TABVLA.X.



Figure 5.
RRR, The lower superficies of the callous body reflected.

STV, The triangular surface of the Fornix or Arch.

XX, The lower part of the partition of the ventricles continued with the Arch.

YY, The upper part of the partition continued with the callous body.

Figure 6.

AAA, The lower surface of the Arch.

BC, Two corners of the Arch by which it is continued with the ventricles.

DE, The right and left ventricles.

FG, Arteries climbing vp from the sleepy arteries thorough the lower side of the ventricles for the forming of that complication of vessels which is called *Plexus choroides*.

H, A vessell issuing out of the 4. Sinus under the Arch, and passing into the third ventricle.

IKL, The diuision of this vessell, a part whereof goeth to the right ventricle at K and another to the left at L.

MN, The *Plexus choroides* made of the artery FG, and the vessell H.

OO, Small veins passing thorough the ventricles of the braine produced from the vessels K and L.

P, Other veins arising from the same, dispersed without the ventricles into the *Pia mater*.

Q, A passage from the third ventricle vnto the *Basin or Tunnell*.

RS, Canales or Sinus grauen or furrowed in the substance of the ventricles in which the phlegme is led along to the orifice of the foresaid passage marked with Q.

The *Plexus Choroides*.
The names.

What it is.

Diuers descriptions thereof.

The *Plexus Choroides* hath his situation in the forward ventricles [tab. 13. fig. 13.] betwixt them and the Arch, they are called *χορδοειδὴ ἀνὰ πλάτη*, because they are like the *χαρπὴν* that is, the After-birth or membrane which compasseth the Infant. But by all Anatomists they are called *Plexus Chors-formes* or *Reticulares*.

They are complications of small vessels in the ventricles of the braine compassed with the *pia mater* [tab. 9. fig. 4. OO. tab. 10. fig. 5. OO. fig. 6. MN.]

How and of what vessels they are made is diuersly set downe by the Authours of Anatomy, and because it is a speciall matter and of subtile conuayance, I will not spare my labour to set downe the diuers delineations of *Archangelus*, *Laurentius Vesalius*, *Fallopins*, and *Banbinc*.

Archangelus

Table II. Figure 7. sheweth the Braine, wherein that part is taken away which made the upper ventricles and did ly upon the Cerebellum: here also the vessell led along from the fourth Sinus, is separated from the Plexus Choroides and so elevated, that the Sinus of the Dura Meninx, and the After-braine it selfe may better be discerned.

Figure 8. sheweth the Braine yet further dissected and more of it taken away, so that the Testicles are divided that you may see the passage of the third ventricle into the fourth, and the Cerebellum uncovered from the thicke membrane.

TABVLA. XI.

FIG. VII



VIII



- A A B B*, Portions of the braine remaining yet in the skull.
C C C, The lines of the convolutions of the braine toward the *Basis* thereof.
D D, The Barke of the braine.
E E E, The white marrow of the braine circumscribed with lines.
F G, Parts of the sleepey arteries.
H, The lower side of the third ventricle distended.
I, The anterior hole of the third ventricle which goeth into the Tunnell.
K, The posterior hole of the third ventricle which goeth vnto the fourth.
L, The pine-glandule vpon which lyeth the venall vessell marked with *V*, when it is in his proper situation.
M N, The Buttocks and Testicles of the braine.
O O, A proesse of the *Dura Meninx* betwixt the braine and the after-braine.
P P Q Q, The first and second *Sinus* of the *Dura Meninx*.
R, The Presse of the braine called *Torcular*, or the congression and meeting together of the foure *Sinus*.
S, The begining of the third *Sinus*.
T, The fourth *Sinus* opened.
V, A reflected and broken vessell of the fourth *Sinus* which runneth into the ventricles.
X X, The *Cerebellum* or After-braine couered with the *pia mater* or thin membrane.
Y, A passage from the fourth *Sinus* into the thin membrane where it couereth the after braine and testicles.
Z Z, The connexion of the thick membrane or *Dura Meninx* with the stony-bone, which containeth the organs of hearing.

Figure 8.

- A A B B*, That part of the braine which remaineth.
C D E, The lines, the barke and the marrow of the braine.
F G, Portions of the sleepey arterie.

H, The fore part of the third ventricle. *I*, The hole vnto the Tunnell or Bason. *K*, Another hole from the passage *L*, deriued to the first hole *I*. *L*, The back-part of the third ventricle descending to the fourth. *M*, The Pine-glandule depressed toward the side. *N O P Q*, The testicles and buttocks of the braine. *R R*, The *Cerebellum* couered with the *pia mater*. *S S*, Certaine vessells which do compasse the *pia mater* and do afford small branches. *T T*, To the sleepey arteries. *V V*, The thicke *meninx* which did inuest the *Cerebellum*. *X X*, Vessells from the *Dura meninx* sprinkled into the *census*. *Z Z*, The connexion of the *Dura meninx* to the skull.

Archangelus thus: It is made of arteries (to which no veines are ioyned) creeping vp into the ventricles through the inside of the braine from that admirable net or complication seated in the saddle of the wedge bone.

Laurentius thus: It is a mazy labyrinth of small veines and arteries running through the parts of the *pia mater* as it riseth vpward.

Vesalius and with him *Platerus* thus: It is wouen of a branch of the fourth artery, and of the vessells proceeding out of the fourth *Sinus* of the *dura Mater*, and of the *Pia Mater*, and a duskish kinde of flesh.

Fallopini

Table 12. Figure 9. Sheweth the Cerebellum drawne a little out of the skull above the Braine, that the lower surface thereof and the cavity of the spinall Marrow might better be discerned.

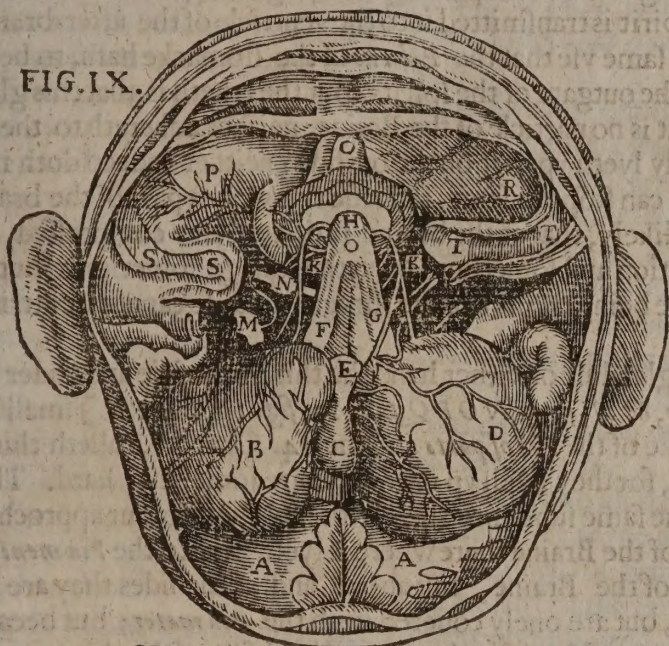
Figure 10. Wherein is shewed a portion of the Braine from which the spinall Marrow taketh his beginning, together with the Testicles, the Buttocke, the Pine-glandule and the fourth Ventricle.

Figure 11. Sheweth a part of the Skull covered with the Dura Meninx, through which the optik Nerves, the Bason and the sleepey Arteries do passe.

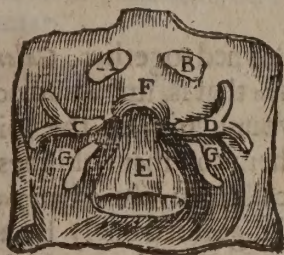
Figure 12. Sheweth the Bason or Tunnell lifted up, and 4. passages which leade the Phlegmaticke excrements of the Braine from the glandule or kernell.

TABVLA XII.

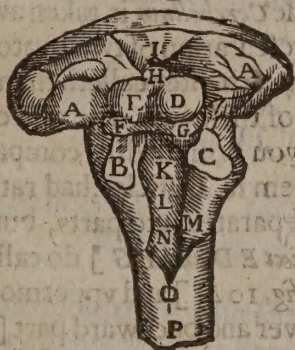
FIG. IX.



XI.



X.



XII.



A A. A part of the braine lift in the skull.

B C D, Three parts of the Cerebellum reflected, inccompassed with the Pia mater and growing to the marrow of the backe.

E, The hindermost processe like to a worme, called *vermi-formis*.

F G H, The beginning of the spinall marrow falling out of the skull to H.

I, The greater part of the 4. ventricle which is excavated or hollowed in the marrow of the backe.

K, Vessels deriued to the Cerebellum, from those vessels which are emptied into the first and second Sinus.

L, Other vessels from the dura meninx, sprinkled into the Pia mater.

M N, The fift and sixt coniugation of nerues.

O, The top of the fourth ventricle like the nebe of a quill.

P Q R, The backward bosome of the skull made to receiue the Cerebellum which bosome is yet couered ouer with the Dura meninx.

S S T T, The first and secong Sinus of the dura mater.

Figure 10.

A A, Parts of the spinall marrow cutte from the braine.

B C, The places where this marrow did grow vnto the braine.

D E, The Testicles. F G, The buttocks, H, the pine-glandule.

From I to K, A part of the third ventricle going to the fourth, vnder the Testicles.

K L M N, A part of the fourth ventricle which is engrauen in the marrow.

O, The top of the fourth ventricle.

Figure 11. A B, Parts of the opticke nerues. C D, The sleepey arteries, E, The Bason or Tunnell hanging downe. F, A hole or perforation of the dura meninx, through which the Tunnell reacheth vnto the glandule. G G, Parts of the secong coniugation of sinnewes. Figure 12. A, The Glandule. B, The Bason or Tunnell called *Peluis* or *Indisfundibulum*. C D E F, The foure holes thorough which the phlegmaticke excrement issueth.

a Pine-apple, broade and round in the Basis, and growne smaller but keeping round to the top; and hereupon it is that it is called *κωνάριον*, and *Glandula Pinealis*: some haue resembled it to the end of the Virile member, & therefore call it *penis Cerebri*, the yarde of the braine. Somewhat long it is, and the Basis sayth *Vesalius* resteth vpon the substance of the braine, but the top regardeth vpward.

The substance of it is somewhat hard, rather sayeth *Vesalius* inclining vnto the nature of a glandule then of the Braine, and couered with the thinne membrane. The coulour of it somewhat differeth from that of the marrow, as being a little yellowish. It lyeth vnder the

Vse.

vessell sayth *Baehne* [tab. 10. fig. 6. H] which goeth to the third ventricle, from which vessell all the webs almost which are in the ventricles doe proceede: and hath the same vse that other glandules haue, which are placed vnder vessels, that is, to confirme their diuisions. For as soone as this vessell entred into the third ventricle, it is presently diuided into many branches couered ouer with the *Pia mater*; and therefore the glandule becommeth to them a strength and stay; but *Archangelus* denyeth this vse of it. Againe, it hath another vse acknowledged by *Vesalius*, *Platerus* and *Laurentius*, and that is to keep the passage of the third ventricle open that it be not stopped by the ingate of the forenamed vessell, and so the Animall spirit hindered from descending into the fourth ventricle.

Archangelus
his conceit.

Disproued.

Archangelus obseruing that this glandule was placed at the beginning of the middle or third ventricle, out of which the spirit is transmitted into the ventricle of the after-braine, thought that this glandule had the same vse that the *Pylorus* of the stomacke hath, to bee a Porter as *Galen* saith to moderate the outgate of the spirits. But the trueth is, that this glandule can haue no such vse because it is no particle of the Braine, neither adhereth to the inward sides of the ventricle, but only lyeth vpon it on the outside; neither indeed doth it so neerely touch the passage as that it can stop the same. Indeepe if it were a part of the braine (sayeth *Galen*) then it were more likely, that as the braine is dilated and compressed, the Glandule also should alter his position and sometimes open the passage sometimes shut it, but seeing of it selfe it cannot moue being no part of the Braine, this vse cannot be attributed vnto it.

The Testicles
and Buttocks.

Vnto the backside of the Pine-glandule on either hand the third ventricle and vnder the Arch doe leane foure [tab. 11. fig. 7, M N, fig. 8. N O P Q, tab. 12. fig. 10. E D F G] small bodies, which *Galen* in his eight Booke of the *Vse of parts* and the 14. Chapter, calleth thinne and long eminencies of the braine, for they swell vp round and are somewhat hard. They are particles of the braine and of the same substance therewith, but their colour approacheth nearer saith *Vesalius* to the colour of the Braine there where it lyeth next to the *Pia meninx*. In their lower part they grow out of the Braine, but aboue and at the sides they are not continued to any part of it or in it, but are onely couered with the *Pia mater*; but because they are scituate between the forepart of the After-braine and backside of the third ventricle, they are better discerned when the *Cerebellum* is taken away.

And because they carry the representation of two buttocks ioyned together, *Galen* in his 8. Booke of the *Vse of Parts* and 14. Chapter calleth them *γαστρίαι* that is, small buttocks; and if you marke well the meeting of these two, and also cast your eye vpon the spinall marrow that descendeth by them, you will readily compare them to a mans thighes set close together. Others comparing them to Testicles, had rather call them *διδυμα* then *γαστρίαι*. Others, because the bodies are not separated into parts, but distinguished onely by an ouerthwart line [tab. 12. fig. 10. betwixt E D and F G] do call those parts of them which are next to the Pine-Glandule [tab. 12. fig. 10 N] and vppermost, Testicles, and those that are lower, Buttocks: because in their lower and backward part [tab. 12. fig. 10, vnder F and G] when the After-braine is remooued, the passage out of the third ventricle into the fourth conspicuously appeareth [tab. 11. fig. 8, K, tab. 12. fig. 10. aboue K] which passage resembleth the very fundament betweene the buttocks.

Their vses.

The vse of these bodies is to sustaine the waight or bulke of the braine, least the third ventricle or the passage [tab. 11. fig. 7, 8, K, tab. 12. figure 10, I K] which goeth out of the third into the fourth should be compressed, and so the Animall spirit intercepted. Some thinke that these particles driue forward the Pine-glandule to shutte vp the passage of the ventricle: and *Archangelus* thus. The Testicles thrust forward the Glandule, and the Buttocks thrust forward the Testicles: for if you deuide these particles and enter a Probe at the back hole of the third ventricle, you shall more plainly perceiue the other part of the third ventricle scituate vnder the Testicles [tab. 12. fig. 10, I, and K, shew the whole third ventricle] which endeth into the fourth.

The fourth
ventricle.

The left ventricle which *Galen* in his 8. Booke of the *Vse of Parts* and the 12. Chapter, calleth the ventricle of the *Cerebellum*: *Laurentius* *sinus quartus*, the Common Anatomists the fourth ventricle [tab. 12. fig. 9, I, fig. 10. L M N O, with tab. 15. fig. 21. H] is scituate betwixt the After braine and the spinall marrow, for it is common to them both: so sayth *Vesalius* It is compounded of the hollownes of the *Cerebellum* and the Marrow of the backe, no otherwise then if you ioine both your hands together and make one hollownes betweene them, or as *Fallopins* hath it in his Institutions: It is scituate in the back part of the Braine,

be-

between it and the *Cerebellum* where the beginning of the *Spinall Marrow* ariseth out of the braine, for in it it is for the most part formed. It is the least and the finest of all the *Ventricles*: the figure of it is round but whitish somewhat long after the fashion of an *EGGE*. At the first it beginneth somewhat large and by degrees is straightned till at length it end in a sharp corner. For the lower and chiefe cavity of this ventricle is in the *Spinall Marrow* [Tab. 10, fig. 10, from K to O] having a hollownesse like a slit, which *Sinus Herophylus* likened to the cavity of a writing pen, the end of it which is resembled to the neb of the pen arising on either side [Tab. 12, fig. 10, N] like a wing. The vpper part of it is made of the *After-braine* and the *pia mater* encompassing it. [Tab. 15, figure 2 I H] For this Ventricle is joined with the *pia mater*, before [table 11, fig. 7, XX, neere to M N] where it ioyneth the *Cerebellum* to the Braine and to his buttocks, behind [tab. 11, fig. 8, as it were ioyning E to H] where it ioyneth the *Cerebellum* to the *Spinall Marrow*.

This Ventricle is not double but single, because out of it the *Spinall Marrow* was to be produced as *Galen* saith; now the *Spinall Marrow* is single, for it had not beene possible, or if possible, it had not beene fit that one Creature should haue had a double *Spine*. The magnitude thereof is conuenient to receyue the *Animall spirits* out of the forward *Ventricles* by the common passage or third ventricle, and to communicate them to the *Nerves* which vnder the head are distributed into the whole body, whence it was that *Herophylus* called this ventricle *Principalisimum*, the most principall. Yet it is lesse then the forward *Ventricles*, because (saith *Galen*) it conteyneth a thing of more power and Faculty. In this ventricle *Vesalius* thought was the seate of the *Memory*, but we know and are able to demonstrate that no cavity of the body is the seate either of the sensatiue soule or of any of her Faculties, but rather the solid substance of the parts.

This Ventricle we finde in Dissections (as also all the rest) to conteyne in it a watery moisture. The two forward beside this water conteyne also the *Plexus Choroides* [Tab. 4, fig. 4, O O, tab. 10, fig. 5, O O, fig. 6, M N] and the third the venal vessel [tab. 10, fig. 6, H I, tab. 11, fig. 7, V, brought out of T] which is propagated from the fourth *Sinus* of the *dura meninx*, and maketh the *plexus* as we saide before more complicated. Many there are who thinke that all these foure *Ventricles* do containe the *Animall spirits* laboured and perfected in the *plexus Choroides*.

CHAP. XIII.

Of the Tunnell, the Flegmaticke Glandule, the wonderfull Net, and the vse of the Braine.

AT the first or forward hole of the third ventricle, or at the sides of that hole or orifice [Tab. 11, fig. 7, and 8, I] we meete with a deepe cavity ioyned aboue to the Braine and made (as saith *Galen* in his ninth Book of the *Use of parts* and the third Chap.) of the *pia mater* compassing the *Basis* of the Braine. For of this *Pia Mater* lengthned out is made a round proceffe or production, [tab. 15, fig. 20, C C] whose beginning is large and ample, [tab. 12, fig. 11, E, fig. 12, B] but after is straightned into a pipe till it end in a long *Fistule* or quill (woven with small but many veines) which through a proper hole [tab. 12, fig. 11, F] made for it in the *Dura mater* descendeth and determineth into the *Pine-Glandule*. This passage by *Galen* in his ninth Book of the *Use of parts*, and of Anatomicall Administrations and the third Chapter, as also by many that haue followed him, is called *peluis the Bason*. He calleth it also in the place before named *χώραν Infundibulum* the Tunnell, because in the top it serueth as a Tunnels top to admit the Humor, and in the bottome like the pipe to let it out; for by this the thicker excrements of the Braine stored vp in the ventricles are received and transmitted to the Flegmaticke Glandule of which we shall speake by and by. *Vesalius* maketh the vpper part to be called *μυστὴρ*, and compareth it to a Bathing tub such as they vse in Hot houses. The neather part *χώραν*, which cannot be better compared then to the pipe of a Tunnell such as they tun Beere with.

Concerning the vse all Anatomists no agree; but *Laurentius* me-thinks for the fashion and the vse compareth it best to such a bagge as we cal *Manica Hippocratis*, in English commonly an *Hippocras bagge*, because through it they tun *Hippocras* which is called *Hippocrates wine*. Next to the *Bason* followeth the flegmaticke Glandule, *Galen* in his 9. Booke de vsu

The Figure.

Calamus scriptorius.

The magnitude.

Herophilus.

The Use of it. Vesalius his conceit disproved.

What euery one of the ventricles contain.

Wondrous

The Tunnell.

The Tunnell.

His Names.

Vesalius.

Laurentius.

Glandulapart- *partium* and the third Chapter calleth it simply *adur*, that is, a Glandule. The seate of it is
under and without the Meninges at the end of the Tunnell in the saddle of the wedgebone.
For this saddle or bosome of the bone was purposely made to receive this Glandule: and
therefore the forme of them both differeth little; for it is flat, hollow above, gibbous below
and almost foure square. The substance is Glandulous, but yet more compact and harder
than other glandules. Thicke it is and compassed about with the *Pia mater* haply with that
part thereof which maketh the Tunnell, and by this Membrane it is tyed to the bone and
leaneth to two branches of the *soporary* Arteries called *Carotides*, which creepe vp by the
sides thereof. [*tab. 12. fig. 12. C D E F*] This Glandule receiue the excrements in manner
of a sponge as they fall from the braine, which excrements it not onely emptieth into the
palate, but also some fall downe by his sides through those holes which are bored in the
Basis of the Scull. Neyther was *Hippoc.* ignorant heereof, who in his Books *de Glandulis* and
de locis in homine saith, that *Humors fall out of the head through the eares, the eyes, the nose, others*
by the Palate into the throat and the gullet, some also through the veins, into the spinal marrow and
into the bloud: that is 7. wayes. For at the sides of this Glandule there are bored two holes in
the bone which descend; one forward ending in that hole where through the 2. payre of
finewes is led, the other descendeth more backward and passeth by the sharp Cleft at the
sides of that hole through which that noble branch of the *soporary* Artery ascendeth into the
Scull, of which outlets we shall speake more at large in the History of the bones.

And these are the wayes by which the phlegme is euacuated out of the braine. For the
braine being great and large stood in need of much aliment, and because it is very moist and
not very hot, out of that much aliment many excrements do arise and are gathered therein;
which excrements being of two kinds thinne and thicke, the thin do vapour out through the
Sutures, the thicke are euacuated partly by the Nostrils as we haue saide already, partly by
the Palate. For those that arise about the Ventricles and are stabled in the diuision of the
braine are purged by the forward hole & the Nose, and is called *Mucus*, we giue it a home-
ly name but proper to it, and call it Snout.

But those that are gathered in the ventricles do most what descend to the Tunnel and are
auoided by the Palate, eyther by simple spitting which we call Rheume, or else by excre-
ation or hawking which we call phlegme. And thus much of the Glandule and vse thereof.

The *Rete mirabile* or wonderfull Net which *Galen* (in the 9. Booke of the *Vse of parts* and
the third Chapter) calleth, *συντροφικὴ ἀλκυα*, [*tab. 13. fig. 14*] that is, the Net like complica-
tion, hath his name from the artificiall figure; for it is made of the *soporary* arteries, [*tab.*
13. fig. 14. AB] which arising vpward from the heart through the chest climbe vnto the head
and at the Basis of the braine neere the originall of the opticke Nerues, do make this web or
Net. This net compasseth the glandule [*tab. 13. fig. 14. E*] at the sides of the saddle of the
wedge-bone, and is not like a simple Net, but as if you should lay many fishers Nets one a-
boue another; wherein this is admirable, that the replications of one are tyed to the repli-
cations of another so that you cannot separate the Nets asunder, but they are all of them so
wrought into one another as if it were a body of net meshed together not into breadth onely
but even into thickenesse also. In these according to *Galen*, the Animall spirits make long
stay; which haue for their proper and immediate matter the vitall spirits raised vp in the
arteries and heere wrought into Animall from whence they are conueyed into the ventri-
cles of the braine. For saith *Galen* (in his 9. Booke of the *Vse of parts* and the fourth Chap.)
where Nature intendeth exactly to forme any thing shee provideth that it shall remaine
some good space in the instruments of concoction. Some are of opinion that the vitall spi-
rits are prepared in these small arteries, and some (*Archangelus* for instance) that the Ani-
mall spirits are inchoated heere and perfected in the *Plexus Choroides*, that hauing recei-
ued their power and efficacy from the Braine and the marrow thereof, they might yssue
into the ventricles and there be stored vp for vse.

Vesalins affirmeth that this wonderfull Net is onely found in the heads of beasts, but wee,
saith *Bauhine*, haue beene able to make demonstration of it in all the mens heads wee haue
hitherto cut vp, although we confesse that in Calues and Oxen it is much greater and more
conspicuous. Now these three particles, the Tunnell, the Glandule and the Net cannot bee
demonstrated before the substance of the After-braine be taken away; and the 2. latter not
before the *dura meninx* be dissected. Finally, before you make demonstration of these three
you must shew the spectators the Mamillary processes and the payres or coniugations of
the finewes, which otherwise in the search for these will be defaced.

Table

Table 13. Figure 13. exhibiteth the vessels of the Braine and their distribution, especially through the right side, whither they proceede from the internall Iugular veine, or from the sleepey Arterie, or from the Sinus of the Dura Meninx.

Figure 14. sheweth the wonderfull Net as Galen describeth it.

Figure 15. sheweth the pituitary Glandule with the Bason and the sleepey Arteries.

Figure 16. sheweth the Rete-mirabile or wonderfull Net, together with the glandule as it is found in the heads of Calves and Oxen.

TABVLA. XIII.

- A, The internall Iugular veine.
- B, The sleepey or Iugular artery.
- C, The first veine.
- D, The 2. veine which is led vnto the Sinus.
- E, The 3. creeping through the dura meninx.
- F, The fourth running into the Sinus.
- G H, The 5. and 6. going to the dura meninx.
- I, The first Arterie.
- J, A branch of the same Arterie running through the Muscles of the necke.
- K, the second artery reaching into the sinus.
- L, The third without a companion.
- M, A small branch of the third Arterie.
- M N, The 1. and 2. Sinus of the dura meninx.
- O, The congresse or meeting of both those Sinus.
- P P, The 3 Sinus of the Dura meninx.
- Q, The end thereof.
- R, The fourth Sinus of the dura meninx.
- S S, Branches of the first Sinus deriued into the Membranes neere at hand.
- T T T T, Branches of the third Sinus disperfed into the Pia meninx.
- V V, The lower small branches of the 3 Sinus.
- X X, The vpper, distributed through the Dura meninx.
- T Y, Certain surcles of the 4 Sinus sent vpward.
- aa, Others sent downward.
- b, The vpper passage of the fourth Sinus running by the Syll.
- cc, Surcles running vpward from this passage.
- de, The right and left vpper branches of the fourth Sinus.
- f, The lower branch going to the pia mater.
- g, A branch of the same passage going forward.
- h, The same bending backward to the Choroides reflected to the Cerebellum.
- i, A notable vessell into the which the 4 Sinus doth determine.
- K, The vppen. The by-partition of this vessell in the braine.
- lm, two branches of this by-partition.
- n, A surcle reaching to the organe of hearing.
- ooo, The distribution of the third veine and artery.
- ppp, Surcles proceeding from the Branches marked with o, deriued into the Pia mater.
- q, The diuision of the third artery where it entreteth into the skull.
- r, A branch reaching to the hollownes of the nostrils.
- s, The end of this in the extremitie of the vessell.
- uu, 2. Branches entring into the skull.
- x, A branch deriued vnto the eye from the coition or meeting of the branches uu.
- y, A branch attaining to the Pia mater.
- z, A branch attaining to the right ventricle.
- z, The complication of vessells called Plexus Choroides formed on either side of the branch marked with A.
- Figure 14. A B, Arteries climbing vp to the glandule or kernell of the gaine.
- Figure 15. A, The Glandule receiuing the bason.
- B, The bason it selfe, or if you will, the Tunnell called Pelus or infundibulum.
- C C, The sleepey Arteries.
- D, A branch of the artery going to the side of the Dura meninx.
- E, Another branch of the same artery going to the nostrils.
- F F, An artery in one side diuided into 2. branches, but in the other side meeting together againe.
- G, A partition of the artery creeping through the dura meninx.
- H, Another branch which getteth out of the skull and reacheth to the eyes.
- Figure 16. A, The pituitary Glandule.
- B C, The sleepey arteries going into the skull.
- D D, The wonderfull Net.



For the use of the Braine. Aristotle (in his second Booke de partibus Animalium and the 7. Chapter) writeth, that the braine was made as a common good for the behoofe of the whole Creature, to temper the feruour and heate of the heart; which opinion because it is

The use of the Braine.

sufficiently refuted by *Galen* in his 8. Book of the *Use of parts* and the second chapter, we will not insist long vpon it, onely these two things we open. First, that the heart is sufficiently refrigerated by our perpetuall inspiration and expiration. Secondly, that if Nature had intended the braine to coole the heart, she would not haue set them so farre distant, but placed it eyther about the heart or at least in the Chest: as well therefore might he haue saide that the Heele was made for the vse of the heart as the Braine.

Diuersē,

Galen.

Wherefore we determine the vse of the braine to be, first for a habitation for the soule whereby she performeth her Animall functions, as well those that are principall as also those of sense and motion. Secondly, that in the substance thereof the Animall spirits might be laboured, herein conveyed and from thence deriued into the body. For so saith *Galen* (in his 8. Book of the *Use of Parts* and the 13. Chapter, and the 9. Book and the 4. Chapter.) *In the whole substance of the body of the Braine is the Animall spirit wrought and reserved, not only in the ventricles*: and in his 12. Booke of Method the 5. Chap. and the third *de locis affectis* and the 7. speaking of the falling sicknesse he saith, *It is caused in the braine, the humor hindering the Animall spirits which are contained in the ventricles that they cannot issue out*. Thirdly, that the Nerues and spinall marrow might proceede from the marrow thereof, which is so manifest as we neede not cite the places of *Galen* to proue it. For the Nerues receiue from the braine as from a principle, as we say *à quo* and of dispensation, the Animall vertue and sensatiue soule which do reside in his substance and do distribute the faculties of sense and motion into the Organs or Instruments of sense and motion as it were through Channels hauing in them the Animall spirits to convey the same faculties.

The Animall spirits.

Aristoteles Comparisons.

This Animall spirit although it performe many seruices, is one and the same; leading all the faculties of the sensatiue soule through the Nerues into all the parts of the body: but the Instruments into which out of the braine it is powred into the Nerues are manifolde. Wherefore if they runne into the eyes which are the Organs of the sight, they make Vision; if into the eares, Hearing, &c. This *Aristoteles* (in his second Booke *de generatione Animalium* and the last text) elegantly declareth by the example of a Smiths hammer, for as the hammer is but one instrument yet doth many seruices according to the variety of subject vpon which it worketh; so is the spirit in the worke of Natures administrations; and as the beames of the Sunne are one and the same yet appeare diuers if they light vpon diuers colours, so is it with the Animall spirits.

The seate of the sensatiue soule.

Animall motion and sense.

The substance of the Braine although it be deuoid of Animall motion and sense (for it is not deuoid of Naturall) yet is it the originall of sense and voluntary motion which we may better perceiue if we consider that disease which we call the Apoplexy. For those that are Apoplectical although all their Instruments of the senses are perfect, yet because the Animall spirits are intercepted they haue no sense at all. For the original of the spinall marrow being totally stopped, all the parts vnder it doe loose both sense and motion: so also if the Nerue which is conveyed to any part be obstructed, that part is deprived of sense and motion. Hence it followeth that the braine is the seate and residence of the sensatiue soule and the fountaine of sense and motion. Of sense, because it receiue the impressions of all sensible things. Of motion because it dispenseth the knowledge of auoiding that which is hurtfull, and desire to follow after that which is profitable and behoouefull.

Naturall sense

Hippocrates.

As for Naturall sense and motion there is a great question whether the braine haue them or no; and first for sense. *Hippocrates* (in his Booke *de vulneribus capitis*) saith, that the braine hath present and exquisite sense about the *Sinciput* or sides of the head, because in this place the bone is the thinnest and most of the braine is there contained; beside, the skinn of the head is the thinnest also. Moreouer saith he, the diseases of the braine are the most acute and dangerous, yea for the most part mortall and hard to bee iudged of by those that are not very well experienced.

Galen.

Galen (in his first booke of the cause of *Symptoms* and the 8. Chap.) saith, that the braine was not made by Nature an instrument with sense, but so that it is able to comprehend or perceiue all those things by which it suffereth, as if he should haue saide, The braine is not made to be a particular instrument of sense, so as it can perceiue or apprehend colours onely as the eyes, fauours onely as the tongue, &c. but it is a common instrument of sensation discerning colours, fauours, smells, sounds and tactile qualities; and in a word all sensible objects.

Wherefore the braine feeleth vniuersally whatsoever is offered vnto it, not with choise as the eye which receiue the sound but onely his owne object and so in the rest. It remaineth therefore that the Naturall sense of the braine is none at all or at least so weak and

and dull as it is hardly perceiued, for in his substance there is rather a faculty of Touching then an instrument of Touch.

Fernelius thinketh that all motion is from the marrow of the braine, and all sence from his membranes; because the body of the braine is perpetually mooued but hath no feeling at all: on the other side, his membranes are of themselves immoueable especially the *Dura mater*, but feelee very exactly. So in the Lethargy or Phrensie which are diseases of the substance of the braine there is no paine at all, but if a sharp vapor or humor be raised vp vnto the Meninges, then grievous paine followeth. Moreouer the spinall marrow and all the nerues haue their marrow from the braine and that couered with the Meninges, all which haue the same and no other power or faculty then what they receiued from their originall: wherefore the forepart of the braine is the beginning of Sence, the hinder part of Motion, but of Touching the Meninges or Membranes are the originall. Those nerues which are full of marrow are the instruments of Motion; of Touching, those whose greater parts are produced by the Meninges. And this is *Fernelius* his Philosophy concerning this poynt, but how consonant to reason we shall see afterward.

Concerning the motion of the braine great difference there is among Authors. *Galen* in his 8. Booke of the *Vse of parts* and the second Chapter, sayth it hath perpetuall motion. *Vesalius* denies it, answers his arguments and addeth that he could neuer perceiue any such motion either in great woundes of the head, or which is more in his dissections of liuing Creatures. *Fallopins* halteth in this poynt, he sayes it but he dares not auouch it.

Platerus thinks that those that say it moues, mistake the motion of the braine for the motion of the third *Sinus*, which beateh like an artery. *Columbus*, *Archangelus* and *Laurentius*, doe all consent that it moueth continually; and instance in woundes of the head. *Laurentius* is so confident that he sayth he is a mad man and wants his senses that will deny it. To resolve vpon somewhat among so many opinions, wee thinke; that the braine is not moued by any Animall or voluntary motion, but by a Naturall and that double: one proper of his owne, another from the arteries, albeit this last *Archangelus* doth deny, because these arteries that runne aboue are too small, but those that are in the bottome of the braine much lesse, yet it giueth the power of voluntary motion to other parts.

This motion is proper and peculiar to the braine, for the generation, nourishment and expurgation of the Animall spirit, for it is dilated and againe constringed as may be seene in woundes of the head where a notable part of the Scull is taken away, as also of the membranes sayth *Babine*. And in children new borne in the mould, the braine is so manifestly seene to beate and pant, that euen the bones which at that time are very soft are mooued therewith. When it is dilated it draweth out of the *Sinus* of the *dura mater* (some say out of the wonderfull net or web of the *sopranie* arteries) vital spirits and ayre by the nostrils, for the restauration and preservation of the Animall spirits, and when it contracteth it selfe it driueth out the Animall spirits laboured in his substance through the nerues, as through pipes and canals into the organs of sence and motion, or (as *Archangelus* hath it) out of the foreward ventricles being contracted into the third and fourth, and so into the organs aforesaide: which spirits when they arrive in the particular parts they nourish the Animall spirits bred and fixed in those parts. For the Animall spirit floweth through the nerues into all the parts, not only to be the conuayer of the sensatiue and mouing Soule, but also to giue nourishment to the Animall spirits fixed in the parts; and this spirit is the *medium* or Meane by which the Sensatiue Soule and all his faculties which are incorporeal are ioyned with the body. The outward parts because their instruments are farther off, stood in need of nerues as it were Channels through which the Animall spirits accompanied by Vitall as it were by guides might bee conuayed, but the inward parts because their instruments are neare and at hand needed no nerues, but receiue the same by blind and inuisible bywaies yet guided by the same Vitall spirits.

We haue also sayd that at the entrance into, and at the out-gate from the heart there are certaine Valves or floud-gates set, and their uses wee haue allotted. Now *Archangelus* is of opinion that the Buttocks and Pine-glandule of the Braine doe here the same offices that the valves did in the heart. For saith he, in the dilatation of the braine the way out of the third vnticle into the fourth closeth it selfe, and beside is shut vp by the glandule falling betweene the Buttocks, that no part of the spirits can returne out of the fourth ventricle into the third. On the contrary, in the contraction the glandule is lifted vp and the Buttocks are diuided, and so a way is made for the Animall spirit to flow out of the third ventricle into the fourth.

Fernelius has Philosophy about this.

The motion of the Braine: *Vesalius* against *Galen*.

Laurentius. What we resolve of.

The use of the motion. How the motion is discerned:

The Animall spirits.

A witty conceit of *Archangelus*.

Con-

Divers opinions of the generation of the Animal Spirits.

Galen.

Concerning the generation of Animall spirits there are diuers opinions; especially seauen, one of *Galen*, another of *Vesalius*, a third of *Columbus*, a fourth of *Argenterius*, a fifth of *Archangelus*, a sixth of *Laurentius*, and a seauenth of *Varolius*, to which *Banvine* our author subscribeth.

Vesalius.

Galen's opinion was, that they were made of the vitall spirit brought by the *soporarie* arteries and of ayre breathed in, mary as for the place of their generation he seemeth to be altogether vncertaine; for sometimes he assigneth the *Plexus Choroides*, sometimes the ventricles, sometimes the substance and body of the braine.

Columbus.

Vesalius sayeth they are laboured in the right and left ventricle by a power and efficacy receiued from the braine, and haue for their matter vitall spirits from the heart, and ayre drawne in by inspiration ascending through the third ventricle.

Argenterius.

Columbus sayth they are made of ayre drawne by the nosethrills and altered in the cauities of the forehead bone and the wedge-bone, and carried through the pores of the spongie bone to the forward ventricles where it meeteth with the vitall spirit sent vpward from the heart by the *soporarie* arteries, and powred into the *Plexus choroides* which is in the ventricles; both which spirits and ayre, sayth he, by the perpetuall motion of the braine and this *Plexus Choroides* are exactly mingled, and of them the Animall spirits are generated in that *Plexus Choroides* which is the ventricles, and this he sayth was his owne inuention.

Archangelus.

Argenterius will haue but one influent or moouable spirit besides the fixed spirits of the particular parts, whose arguments shall bee sufficiently answered in our Controuerfies by *Laurentius*.

Laurentius.

Archangelus opinion is, that the Animall spirits are made of the vitall, changed by many exagitations and alterations by the arteries which make the *Rete mirabile* and the *Plexus Choroides*, but receiuing their vttermost perfection in and by the substance of the Braine, and so become a conuenient vehicle of the sensatiue soule. The proceffe of which generation he sayth is after this manner. There is an inchoation or beginning made in the *Rete mirabile*, but the plenarie perfection is in the *Plexus Choroides*, yet that from a power or facultie of the marrow of the braine in which alone such power resideth; being so perfected they are powred out into the ventricles (which adde nothing to their generation) as into store-houses or places of receite where they are kept to bee transported into the whole body.

Varolius.
What we resolve of.

Laurentius thus, the Animall spirit is generated of the vitall spirit and the ayre breathed in; whose preparation is in the labyrinthian webs of the small arteries, and in the vpper or forward ventricles; but they receiue a farther elaboration in the third ventricle and their perfection in the fourth, and from thence by the nerues are diffused into the whole body, but he reprehendeth those that auouch that this spirit receiueh his forme and specifical difference in the webs before named.

Banvine.

Finally *Varolius* and with him *Banvine* and wee with them will resolve, first for their matter that it is arteriall blood abundantly fulfilled with vitall spirits and ayre drawne in by the nosethrills; for the manner we say it is thus. The spirituous and thin blood is sent vp from the heart by the *soporarie* arteries vnto the braine, and is powred out into the *Sinus* of the *dura mater* whilest they are dilated as is venall blood out of the veines. With this is mingled ayre drawne by inspiration through the nosethrilles, and arriuing into the braine through the pores of the spongie bone. These substances thus mingled and mixed in the vessels, whilest they are carried through the conuolutions of the Braine are altered and prepared, purged also from phlegmatick excrement, which whilst it nourisheth the braine, the more subtile part is transfused into his substance, and there, that is, in the marrowy substance of the braine, it is laboured into a most subtile Animall spirit, and so is from thence by the same passages returned and communicated to the spinal marrow and to the nerues of the whole body. Neither saith *Varolius* is it necessary that these spirits should haue any cauities to bee laboured in; and hee sheweth it by an example. When wee shut one eye the Animall spirit in a moment returneth vnto the other, so that it dilateth the ball or pupill of the other, and yet is there no manifest passage betweene them, sauing those insensible pores which are in euery nerue and also in the substance of the braine. And hereunto subscribeth also *Platerus* on this manner: The common opinion saith he, is that the Animall spirit is generated and containd in the *Plexus Choroides*, which I cannot approue as well because the vesselles are so very small, as also because so many excrements of the braine fall through the ventricles. I thinke therefore that the Animall spirit is tyed to the substance of

Platerus.

of the braine, so that the braine is neuer without Animall spirits, neither can the Animall spirits subsist in any part without the substance of the braine: for what else is the inward substance of euery Nerue but a kinde of production of the braine compassed about with a production also of membranes of the same?

And thus much shall bee sufficient to haue sayed concerning the vse of the Braine and the generation of the Animall spirit. Now wee proceede to the After-braine or the *Cerebellum*.

CHAP. XIII.

Of the Cerebellum or After-braine.

Hat the whole Masse of the Braine is diuided into the Brain and After-braine we haue already shewed. The cause of this diuision *Varolius* taketh to be this. Where- as of those things which are apprehended by the senses there are two chiefe, differing much the one from the other, yet both of them so immediately seruiceable to the vnderstanding that they cannot bee substituted one for the other; whereof one belongeth to the Sight the other to the Hearing; and because there is required to the perfection of sight the mediation of a moyst and waterish body as we see in the eyes; therefore for their behoofe especially and of the visible Species which they admit, that part of the braine was made which is the softer and so great that it filleth almost the whole Scull; and this is called properly *Cerebrum* or the Braine. But because those Species which are apprehended by sound, or resounding, do require a kinde of driness in their Organ, as *Hippocrates* excellently acknowledgeth (for where there is onely moysture there is little or no resonance at all): therefore vnder the braine in the backpart of the head there is ordained and scituated a lesser and faster portion which they call *Cerebellum* we the After-braine, which as it is truly harder then the braine it selfe, so is it consequently dryer. And this is *Galens* opinion in the 6. Chapter of his 8. Booke *de usu partium* where he saith; that therefore it is harder then the braine because it produceth hard Nerues; albeit *Vesalius*, *Columbus* and *Archangelus* wil not admit any difference in their substances. Wherefore the Braine it selfe was especially made for the behoofe of the eyes, and their objects: the After-braine for the vse of resounding species or such things as were to be represented to the hearing. And because the sight is more excellent then the hearing, ministring vnto vs more difference of things, therefore it is seated aboue the After-braine.

The *Cerebellum* or After-braine, called in Greeke *παρυκισμα* and by *Aristotle* *εμπρις*, that is *after the Braine*; is as it were a priuate and small Braine scituated in the backe and lower part of the scull vnder the Braine [tab. 11. fig. 8. R R] from which it is separated: it is also couered with both the Meninges or Membranes, and is vnited to the spinall marrow for a little space where also it affoordeth a part out of it selfe to make the bulke of the same narrow.

In brute Beasts it is round and acuminated or growing sharpe and taketh vp almost all the backpart of the head. It is continued on eyther hand to the sides of the Braine by two orbicular or round portions: [tab. 11. fig. 8. neare H G] But to the spinall marrow it is ioyned in the very middest, yet toward the backside, [tab. 12. fig. 9. E] by the interposition of the *Pia mater*: And because the fourth ventricle should not there start open it is compassed with the thinne Membrane which is spred as farre as to the Buttocks. [tab. 11. fig. 8. betwixt O P and Q] It is separated from the braine that through the thicke Membrane the vessels might be securely conueyed into the depth of the braine.

The forme of it is broader then long or deepe, and in the lower and backpart it resembleth a flat bowle, in the middest whereof there is a sharpe impressiō ietting out from the bunch of the Nowle-bone; forward toward the buttocks of the braine it runs into a sharpe wedge hauing that figure because the place will admit no other.

It consisteth of three parts, the right, the left, and the middle (which yet are not diuided but continued) because of the bunch of the Nowle-bone, of which we shall speake more particularly heereafter.

The right and the left parts are like two bowles set together, [table 12. fig. 9. B D] in the middest of which where the bowles do not touch, is placed the third part which is rounde and

The reason of the diuision of the Braine.

Galens.

Vesalius. Why the brain is aboue the after-braine. The After-braine.

Aristotle.

His connection.

The forme of the after-brain.

The parts of it.

Table 14. Figure 18, sheweth the head on the left side somewhat raised from the right side, as also a part of the Braine (the After-Braine being remooued) remaining, and a little elevated and reflected backward, that the Instruments of smelling might be discerned.

Figure 19. sheweth the Head set upon the Nowle, that a portion of the Braine hanging backward, the Organs of smelling, the coition or meeting of the Optick Nerves and the Soporary Arteries might better appeare.

TABVLA. XIII.

FIG. XVIII.



XIX.



MN, The right and left optick nerves. *O*, Their coition or coniunction. *P*, A branch of the Soporary artery, perforating the *dura meninx* at the side of the Tunnell. *Q*, A branch of the Artery reaching to the right ventricle. *R*, Another branch going to the *Pia mater*. *S*, The Tunnell receyuing the Phlegme of the braine.

and runneth as it were into a Ring from before backward, and maketh those processs which are called *vermiculares*. By reason of these parts it hath three-fold impressions, some ouerthwart and scored along thorough it; others running right downward which are ioyned on eyther side as it were vnto a Center. For the lines it hath are long and almost superficially, yet diuided manifold and distinguished by the thin membrane running betwixt them. The reason why they run in the superficies or surface onely is, because if they did descend deeper as we see in the Conuolutions of the Braine it selfe, they would perforate the *Cerebellum* even vnto the ventricle. They are also manifold that their plenty might supply their superficial course; as for those long and winding contortions which are in the braine, in this After-braine they are not to be found.

The Lines.

Why superficially.

The substance

The substance of it is almost the same with the substance of the Braine it selfe, if wee take it freed from the *Pia mater*, excepting in the *Basis* of the Braine where the spinall marrow beginneth, which is harder then all the other parts, yea then the After-braine it selfe.

For

A A, B B, The braine couered with the *pia mater*.
CC, The swellings of the braine called by some Mammillary processs.
D, One of the organs of smelling remaining yet in his owne seate.
E, The other together with the braine reflected backward.
F, The *Sinus* of the left organ of smelling couered here with the thicke *meninx* perforated.
G, The partition of the organs of smelling.
H, The sixth veine of the braine deuied into the *dura meninx*.
I, The fifth veine of the braine which goeth into the scull through the hole, ordained for the issuing out of the Nerves of the 5. coniugation.
K, A part of the Syth growing to the partition.
L M N, The place or seate of the *Cerebellum* or After-braine.
O P Q, The right, left and middle *Sinus* of the *dura meninx*.
SSS, The double Tabulature of the scull.

Figure 19.

A A, B B, A portion of the braine couered with the *pia mater*.
CC, Those swellings of the braine which are called the Mammillary processs.
D E, The organs of smelling reflected together with the braine.
F F F F, The two upper shew the bosomes of the scull in which the Mamillary processs do rest; the two lower shew the bosoms or cauities of the organs of smelling.
G, A partition distinguishing these organs and their bosomes or cauities.
H, The 6. veine doth here enter into the scull.
I, The fifth veine of the braine.
K, A vessell like a veine running out of the *dura meninx* into the *Tennit*.
L L, The beginning of those passages which run by the sides of the *dura meninx* ioyned to the arteries after the manner of Veines.

the After-braine.
 braine. E. The an
 the After-braine o
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Table 15. Figure 20. sheweth the head turned upon the Eare, that the inner Basis of the Skull covered with the Dura meninx might be seene, there is also so much of the Braine and spinall marrow left, as serveth to exhibite the coniugations of the nerves of the Braine.

Figure 21. sheweth the After-braine taken out of the Skull, separated from the spinall marrow, and lying with the lower side upward: from which also the wormy processes are severed.

TABVLA XV.

FIG. XX.



XXI.



A A, A part of the marrow of the braine, together with the beginning of the spinall marrow.

B B, A portion of the opticke nerves.

C C, The Tunnell receiuing the phlegme.

D, A hole out of the third ventricle into the Tunnell.

E F, Branches of the soporary arteries, attaining vnto the skull neare the Tunnell.

G, The second paire of nerves moouing the eyes.

H, The third coniugation, or the greater roote of the third coniugation.

I, The third paire of nerves, after some the fourth.

K, the fourth paire of the brain.

L, The lesser roote of the fift paire.

M, The fift paire of nerves of the braine.

N, The beginning and furcles of the sixt paire of nerves.

O, The beginning of the seuenh paire of nerves.

Figure 21.

A B, The right and left part of the After-braine. C D, The anterior and posterior regions of the middle part of the After-braine. E, The anterior wormy proceffe. F, The posterior wormy proceffe. G G, In this place the After-braine did grow to the spinall marrow. H, The cavity in the spinall marrow maketh the fourth ventricle. I K, The anterior and posterior proceffes of the braine, called *vermi-formes* or the wormy proceffes.

For this spinall marrow neither in colour nor in hardnesse is answerable to the *Cerebellum*, because the After-braine is yellower or rather more Ash-coloured, being no where white but in the surface of his ventricle; but the spinall marrow is exceeding white, as also is the Basis of the Braine which giueth beginning vnto it.

The quantity of the After-braine is much lesse then that of the Braine. The Braine being as sayth *Fallopins* foure times, as *Vesalins* would haue it, tenne times as bigge as the *Cerebellum*.

In the middest thereof it hath a broad *Sinus* or hollownesse not very deepe, which maketh as it were the rooffe or vpper side of the fourth ventricle, for the rest of it is covered with the thin membrane; [tab. 15. fig. 21, H] with-in-ward it hath no cauities as hath the braine, because it neither aboundeth with so many excrements, and those it doth gather, it easily turneth downe on the out side.

It hath two proceffes (*Platerus* reckons foure) [table 15. figure 21. C D] which because they are like to wormes in rotten wood, *Galen* in the 14. Chapter of his 8. Booke *de vsu partium* calleth *vermi-formes excrefcencias*, Wormy proceffes, one of which regardeth the fore side, the other the back of that ventricle which is common to the After-braine and the

The quantity.

The Sinus.

Platerus.
Galen.

The wormy
proceffes.

spi-

spinall marrow. These processes are diuersly orbiculated or rowled vp, consisting of many particles, not oblique or right but transuerse, coupled together by the *Pia Mater* or thin membrane, whose end or top is embowed and thinne (which *Aurantius* calleth the *pease*) and entreth the cavity which they call the Cisterne, yea into the fourth ventricle.

Aurantius

Archangelus
his opinion of
the substance
of the wormy
processes.

Archangelus maketh this wormy processe not as *Galen* would haue it, to bee of the substance of the braine and a part thereof, but a long membranous body, being indeede nothing else but the *Pia Mater* corrugated or foulded together, which in the dilatation of the braine is necessarily extended: but in the contraction is corrugated or crumpled vp like a worme.

For because (sayeth hee) the braines of those that die are contracted and fall into themselves, it necessarily followes that after death the membrane must in that part bee contracted.

It appeareth also thicker then otherwise the crumpled membrane would, because being scituated in a low part, it receiue the moysture there collected and encreaseth with that additament. Wherefore sayeth hee the worme as it is a worme is of no vse at all. But to returne.

The first pro-
cesse.
Galen vse of
the wormy
processes.

We saide these wormy processes were two, the first which lyeth on the forepart [*tab. 15. fig. 12. C*] neare the buttocks is thought by *Galen* in the 5. Chapter of his 9. Booke of Anatomical Administrations, to keepe open the passage of the third ventricle into the fourth; albeit *Vesalius* taxeth *Galen* for assigning that vse vnto it. *Galen* also in the 14. Chapter of his 8. Booke *de usu partium* sayth further, that this processe when it is extended ouer the foresaide passage doth wholly obstruct or stop the same; but if it be reflected backward and rowled vp, his imbowed parts do draw the membrane to them adioyned, and the passage is so farre opened as way is made by that retraction. For as it is reflected and rowled round, by how much the length of it is diminished by so much the breadth is encreased; wherefore it behoued not, that these processes should be either too thicke or too thin: not too thicke, for then they could not haue exactly closed the passages because they should haue had no slender parts which might haue insinuated themselves into the narrow straits of the passages. Againe, if they had beene too thin, the passages before said could neither haue bin exactly shut nor well opened.

And least these processes should altogether fall into the passages, Nature hath on eyther side bound and conioyned them to the buttocks with slender bodies which the Anatomists call *Tendines* proceeding from the thinne membrane; which membrane being extended to the hinde-most ventricle maketh the end of this processe. And this is *Galen*'s Anatomy concerning these processes, and deserueth well to be considered of, especially if wee make our dissection of the head after the ordinary and accustomed manner.

The 2. pro-
cesse.

The other processe [*tab. 15. fig. 21. F D*] which is the hinder, and from behind inclineth forward, doth not beare out as the former did; but his poynt is rather hid in the substance of the *Sinus* of the After-braine.

Their vse.

The vse of the first is to vsher the spirits; of the second that the way or passage of the fourth ventricle (which *Galen* in the 11, 12. and 13. Chapters of his 8. Booke *de usu partium* calleth the ventricle of the *Cerebellum*) might not bee obstructed by the After-braine pressing vpon it. But wee are of opinion that this is the common vse of both the processes, because this passage (so often now mentioned out of the third into the fourth ventricle) ought neuer to be shut but to remaine alwayes open that the Animal spirit might haue perpetuall free influence into the spinall marrow. *Platerus* thinkes that this vse is common to all the foure processes (for he reckoneth foure.) But *Vesalius* assigneth to them no other motion or office then to the rest of the substance of the *Cerebellum*, but if you aske his reason, I thinke it was onely that he might gain-say *Galen*.

Vesalius sup-
posed

The Vse of the
Cerebellum.

At the sides of these processes we meete with two other portions which are continuated to the spinall marrow [*tab. 15. fig. 21. G G*.]

The vse of the After-braine (as saith *Galen* in the 6. Chapter of his 8. Booke *de usu partium*) is that from it the harder nerues might haue their originall: which notwithstanding *Vesalius* and *Columbus* doe denie. *Archangelus* and *Platerus* esteeme it to bee of the same nature with the braine and adorned with the same faculties. *Galen* thinkes that that Animal spirit being contained in the whole substance of the braine, not onely in the ventricles thereof, is in great quantity treasured vp in this After-braine, as being to be the originall of all the sinewes which were to bee distributed into the whole body: and that those middle

dle distances which tye together the parts heereof, are the paths and wayes wherein the Animal spirits disport themselves.

Finally, *Varolius* conceiue, (which we partly touched before) that the Braine was especially made for the eyes and the visible objects. The After-braine for the eares and resemblances of sounds to be conueyed vnto them.

Varolius.

CHAP. XV.

Of the spinall Marrow or pith of the Backe.

THE name of Marrow is properly attributed to that substance which is simple and vniforme, moist, fat, white, without sence, contained in the Cavity of bones, and hath his originall from the blood; which through the veines slideth by secret pores & passages into their hollownesse or spongy sides. It becommeth white and as it were spermatall by a mutation it receiveth from the bones, because in them it is stored to be their proper nourishment & to refresh them when they are heated & dried by motion or other violent causes.

What true marrow is.

But of this marrow wee do not intreat at this time: the name is improperly given to the Braine also and the pith of the Backe: For the Braine it selfe is called *μυελος ἐγκεφαλίου* *medulla cerebralis*, the Marrow of the Braine, because saith *Plato* the substance thereof is marrowye, although there be great difference betweene them, for that it will not melt and consume as marrow doth, and beside is inuested or clothed with both Membranes the thicke and the thin *meninx*.

Why the braine is called marrow. *Plato.*

Moreouer to distinguish it from ordinary marrow, it is called by *Galen* *ῥαχιδος σπινάλις*. By *Hippocrates* in his book *de Carnibus* *varia* *Dorsalis*, by others *Cervicalis* and *Lumbaris*, because it descendeth through the Neck, the Backe and the Loynes, and filleth the whole spine or Ridge-bone.

The names of the pith.

Now there is a double acceptation of the Spinall marrow, for in the larger signification it signifieth the whole marrow of the brain lengthened out, one part wherof is yet contained in the Skull, [*Tab. 17. fig. 1 from D to E*] the other continuall with the former yssueth at the great hole of the Nowle-bone & descends to the very end of the ridge. [*Tab. 16. fig. 1. from A to H*]

A double acceptation of the spinall marrow.

But in a strict & more proper acceptation it betokeneth that part of the marrow which without the Scull is contained in all the racke-bones or *vertebra* of the spine or chine. [*ta. 16. fig. 1. is an expresse Image of it*] Wherefore that it may be free from all ambiguity, the history thereof is on this manner.

That which is commonly called the Braine, that is, the whole substance included within the Scull we haue diuided into the Shell and the Kernell or Marrow. For these two differ in colour and consistence. That which on euery side compasseth the marrow is Ash-coloured; the marrow it selfe is white and of a more solid, fast and compacted substance: and these two parts in Greene or fresh heads are distinguished by many oblique lines, so that with a rayser they may be separated if a man haue a steddy and cunning hand, yet not without breaking both the substances; so that *Archangelus* said well, that the white was drowned in the Ash-coloured as the cristalline humor of the eye is in the glasse; and as the glasse humor is esteemed to be the Aliment of the cristalline, so the Ash-coloured substance may well be thought to be the foode of the white, because the Ash-coloured appeareth so to be by reason of innumerable veines disseminated through it.

The parts of the Braine.

Archangelus.
An elegant Comparison.

The marrow it selfe may be said to be double, one Globous or round, the other Long. The Globous part which is like the figure of the Scull, is of a great bulke and therein are ventricles excauated or hollowed. At this and continuall with it hangeth the other called *Cerebellum*, of which we haue intreated in the Chapter going before according to the receiued opinion of Anatomists.

The marrow double. Globous.

The Long marrow of the Braine which is like a Pith or staffe may be deuised into that part which is contained within the Scull, & that which is yssued out which properly is called the spinall marrow; although some there are that giue this name vnto all the Long marrow of the Braine as well within the Scull as without; and this is it of which wee now speake.

Long.

The Spinall Marrow therefore according to this large signification taketh his beginning (as *Galen* saith in the tenth chapter of his 8. Booke *de vsu partium*) from the backe ventricle of the Braine; for he thought it nothing else but the Braine lengthened, which may seeme to agree with the Scripture which calleth it *The silver cord*. And this, he saith in the twelfth chapter

The originall of the spinall marrow.

Ecclesiastes.

ter of the former book, is continuat onely with the Braine at the Basis thereof.

There be many opinions of the originall of this spinall marrow, we will reckon vnto you the most notable.

Diuers opini-
ons.

Hippocrates.
opinion.

Galen.

The common
opinion.

Vesalius.

Archangelus.

Platerus.

Columbus.

Varolius.

Laurentius.

The scituation
and propor-
tion thereof.

The spirall
Marrow pro-
perly so called.

Galen.

His course.

The 3. Mem-
branes of the
Marrow.
The first.

The vse of
the humor.

The first is that of *Hippocrates* in his booke *de Carnibus*, where he saith in generall words that it ariseth from the Braine. *Galen* more particularly and distinctly, from the hinder ventricule of the Braine. The common opinion is that it ariseth out of the *Cerebellum* or after-braine. *Vesalius* saies from the Basis or foundation of the Braine. *Archangelus* from the Globous part of the marrow of the Braine, betwixt the braine it selfe and the *Cerebellum*, for those that say it hath a double beginning say as much as nothing. *Platerus* thinketh that it proceedeth like a new Long Braine from the Basis of the other and receiueh increase of strength from the *Cerebellum* also. *Columbus* saith it is nothing else but a Long Braine hauing a double beginning, the one greater from the Braine it selfe, the other lesser from the after-braine. The beginning it hath from the braine is but single, that it hath from the after-braine is double and as it were forked into a right and a left. The greater originall is from the forepart of the braine but a little distant from the Region of the Opticke sinewes, and therefore, saith he, I am constrained to confesse that the 3, 4, 5, 6, 7, and 8. paires of sinewes do not arise from the braine but from the spinall marrow.

Varolius who indeed was excellent in dissecting of the head saith, that there yssue from the braine and the *Cerebellum* foure roots making one notable trunk which they call the spinall marrow, out of which do yssue Nerues deriued vnto all the parts of the body. *Laurentius* is also of the same opinion. The truth is, that it is a production as well of the braine it selfe as of the after-braine out of which it proceedeth as a stemme from the roote, which we shall more particularly shew afterward.

This spinall marrow lying vnder the *Cerebellum* to which it is continewd, taketh vp that hollownes of the Scull which is aboue the great perforation or hole in the bone of the Nowle or back-part of the head; and the beginning thereof for the length of foure fingers breadth cleaueth to the braine within the Scull, [Tab. 17, fig. 1, from D to E] the latitude and depth of that originall are so æquall that it appeareth almost circular neere the quantity and forme of an Hens Egge as *Archangelus* saith; and from this originall those Nerues which are accounted the proper sinewes of the braine together with the Organs of smelling are produced and deriued into the Instruments of the five senses, as *Varolius*, *Plater*, *Archangelus*, *Laurentius*, and *Dominicus* do ioyntly agree.

But the spinall marrow properly so called or the other part of it which is continuall with the former [Tab. 16, fig. 1] is wholly without the Scull. For when the marrow of the braine now lengthened attaineth vnto the great perforation in the Nowle-bone [Tab. 13, fig. 17, H] it descendeth and passeth along through the holes of the rack-bones euen to the end of the *os sacrum* or holy bone. It passeth I say through the bones themselves, least being soft and like the substance of the braine as *Galen* speaketh, it should in the length of his production suffer violence by those things which might light vpon it, whereas now the bones are as it were a safe conduct and firme defence thereunto all the way that it passeth.

And hence it is, that the *Gracians* call this perforated part of the spine, *ἡ ἁγία στήλη* *sacram fistulam* the holy pipe. Sacred or holy because it containeth a principall part, and a pipe because it is as it were fistulated or bored, through which Cavity such a substance is transported as where from all the other Nerues are produced.

It is inuested or cloathed with three membranes which *Hippoc.* in his booke *de Arte* calleth *ἐνυττα*. The first of which, according to *Galen*, ariseth from a strong ligament exactly fastening the fore parts of the *vertebra* or rackebones, which ligament in the backpart determineth into a Nervous and strong coate, least in the bending or extension of the spine it should be broken or offended by the bones, because it is contained not as the braine in any immouable bone, but in rack-bones, which are not onely moued but also sometimes somewhat dislocated. Wherefore the Nerues also which arise from the spinall marrow properly so called (least they should be offended by the hardnes of the bones through which they passe) are clothed beside the two Meninges with this third coate also.

About this is a thicke and slimy humour powred, as also about all the ioynts and parts that were to bee moued; least being ouer dried they should suffer paine, and so their actions or functions be interrupted; which wisdom of Nature men doe imitate when about the Axle-trees of Carts and Coaches they smear a soft and viscons grease that they might more euerantly moue.

The

The second membrane ariseth from the *dura mater* or hard Meninx; the third from the *pia mater* or thinne Meninx [Tab. 16. figure 1, expresseth the coates ioyned together] which two are not separated as they bee in the braine: moreover the thicker secureth the marrow from the bones, the thinner infoldeth his vessels and closely bindeth together his soft substance, for through the thinne membrane the veines and arteries which nourish the marrow and supply it with vitall spirits are conuayed; which vesselles we haue obserued to proceede from the veines and arteries of the loynes as wee haue already shewed in the third Booke.

The second
and third
Membrane.

The substance of this spinall marrow is all one with that of the Basis of the braine, or rather of the globous marrow. Wherefore it is somewhat hard, compacted and white, yet so that it is much harder then the braine it selfe. And *Galen* in diuers places of his ninth Booke *de vsu partium* saith, that this spinall marrow is the originall of the harder nerues, as the fore-part of the braine is of the softer: for to the strength of motion a harder production was more behoofefull; and for the exactnes of sense a softer. Note againe that the further it is distant from the braine, by so much it is harder & more compact; neither is it answerable to the colour & hardnes of the *Cerebellū*. For the *Cerebellū* or after-braine is only white in the surface of his ventricle, other-where it is yellowish or Ash-coloured; but the spinall marrow is very white most like to the marrow of the braine, sauing that it is without any contortions or conuolutions, because it is made onely to receiue & not further to labour that it hath receiued.

The vessels of
the marrow.

His substance.

Galen.

With the Braine it hath these things common; first his substance, secondly that it is an originall of sinewes (*Galen* addeth of all sinewes) and is compassed with both the Meninges. Yet heerein they say it doeth not communicate with it, because the braine (though it bee containd within an immouable bone) yet beareth and is moued; whereas this marrow albe it be containd within mouable spondels or rack-bones, is not it selfe at all moued. But if that motion bee in the substance of the braine by an in-bred faculty, and the spinall marrow hath the same nature and substance that the braine hath, me thinkes it should bee reasonable that this marrow should bee moued in like manner as the braine is moued, albeit our sense is not apprehensue of it. And truly *Archangelus* conceiueth that it hath a motion, and when it is dilated receiueh Animall spirits from the fourth ventricle, and when it is contracted powreth them againe forth into the nerues which arise there-from.

What it hath
common w. th
the Braine.

The figure of it is long, thicke and large at the originall, [Table 17. Figure 1. from D to E Tab. 16. Figure 2. from A to B] and though being gathered together it become somewhat narrower, yet is it not (as some thinke) by little and little continually attenuated till it come to the extremity of the *os sacrum*: for as far as the *vertebrae* of the loynes [Table 16. fig. 1. from I to K] it keepeth an equall thicknesse almost; although *Galen* and *Vesalius* did thinke that it was consumed as it sent more nerues out from it. *Fallopins* in his obseruations and *Platerus* doe not thinke that it groweth lesse at all. Yet wee must needs acknowledge that we find it fuller and thicker in the neck whence those great nerues issue which are dispersed through the armes [Table 16. fig. 1. from I to K] and in the loynes whence proceede the great nerues of the loynes which descend vnto the thighs; [Tab. 16. fig. 1. from B to C] and that afterward when it commeth nearer to the *os sacrum* his marrowy substance is somewhat abated.

The figure.

A cavity or *Sinus* there is formed in it presently after his originall whilest it yet remaineth within the Skull; which is like a writing-pen, and therefore it is called *Calamus scriptorius* [Table 12. fig. 10. KLNO] for it is hollowed into a poynt or nebe becomming lesse by degrees, because in that place there are no more excrements.

His cavity.
Calamus scriptorius.

This cavity maketh the middle part of the fourth ventricle of the braine; for the rest of the ventricle is formed by the after-braine [Table 15. figure 21. H] at which place the After-braine is ioyned to this marrow. [Table 15. figure 21. GG is ioyned to B C as also in the 12. Tab. and fig. 10.] *Archangelus* conceiueth that this cavity is vnder the fourth ventricle and continued with it, and that out of the fourth ventricle into it the Animall spirits doe flow, and that from this cavity they are distributed most what into all the five senses.

Archangelus.

And although the marrow bee but single and seemeth to haue no manifest cavity, yet in the very middest it is deuided into two parts by the thinne Meninx as far as to the rack-bones of the loynes; so that on either side there appeareth a little cavity which may not onely be demonstrated in the marrow of an Oxe if it bee lightly boyled, but also as sayeth *Platerus* in a mans, because it may bee parted asunder without laceration. *Archangelus* thinks this cavity to be sufficiently manifest to the eye; we are sure to the vnderstanding it is most apparant, by that we finde in those that are troubled with the Palsie, in whom sometimes one side sometimes another is alone affected. Howsoeuer the marrow appeareth simple and

His cavity.
Calamus scriptorius.

Table 16. Figure 1. sheweth the true forme of the spinall Marrow properly so called, together with his membranes and nerves proceeding from the same.

Figure 2. sheweth the spinal marrow naked and bare, as it appeareth both within the Skull and without, together with his nerves as most part of the Anatomistes heretofore haue described it.

A, The beginning of the spinall marrow where it falls out of the skull.

B, the thicknes thereof in the spondels or rack-bones of the loynes.

C, the diuision thereof into strings, or hairy threds.

D, the seauen nerves of the necke.

From D to E or from 7, to 19, shewe the nerves of the backe.

From E to F, the nerves of the loynes,

From F to G, the nerves of the os sacrum or holy bone.

H, the end of the marrow.

IKL, do shew how the nerves do issue from the marrow in strings.

MM, the knots of the sinewes made of the coniunction of those strings.

NO, the membranes that inuest the marrow.

Figure 2.

A, the beginning of the spinall marrow in the Skull.

4, 5, 6, 7. These Characters shew (according to Vesalins opinion) how the coniugations of the nerves of the braine doe take their originall from the marrow remaining yet within the Skull.

B, the egresse of the spinall marrow out of the skull.

C, the cords or strings whereinto it is diuided.

D 7, the marrow of the neck and seuen paire of sinewes.

E 19 twelve pairs or coniugations of nerves proceeding from the marrow of the Chest.

F 24, the marrow of the loynes and 5. paire of sinewes.

G 30, the marrow of the holy-bone and 6, paire of sinewes.

H, the extremity or end of the spinall marrow.

undeuided passeth through the whole necke and the Chest euen vnto the loynes and lower; [Table 16, Fig. 1. from A to B] and in his passage it scattereth nerves out of his sides: afterward, that is, at the rest of the loynes it is no more simple but deuided into many small threds and filaments, very much resembling a horse tayle and so runneth on to the end of the os sacrum.

For as it began with the spine (we meane the marrow properly so called) so it determineth therewith, sometimes simple sometimes deuided into three short surcles. For it was necessary that in that part where the spine was especially curued or bent backward or forward, it should be diuersly diuided that it might not be compressed by the vertebra. Hence the reason appeareth why a hurt or annoyance in the lower part of the spinall marrow is worse and more dangerous then in the vpper, because below it is more Nervous, aboue more marrowy.

Now although the Nerves yssuing from the spinall marrow be almost infinite, yet according to the number of the out-lets or holes of the vertebra they are said to bee so many coniugations as the vertebra haue holes. For euery Nerue doth indeed consist of many hairy strings or marrowy fibres, which by the helpe of the Membranes at the holes of the vertebra are conioyned & making as it were a knot doe yssue out of the bone, so that one Nerue seemeth to be made of one propagation, [tab. 16, the figure sheweth it at LL] which thing as it is true in those Nerves which proceede out of the Marrow whilst it is simple and single, so is it also in them which after the diuision are distributed into the lower parts. [table 16, fig. 1, as MM.]

How it may
be said to be
deuided and
where.

Whereof his
nerves are
made & how
they yssue.

TABVLA. XVI.



To put an end to our description of the spinall marrow, we will take leave to insert in this place a description thereof out of *Rondeletius* and *Laurentius*, which is on this manner. All the Nerues, (saith *Rondeletius*) which no man before me hath obserued, are diuided from the very beginning of the spinall marrow in the Braine. Wherefore the cause of the Paralysis or Palsie doth not so much proceed from the marrow of the backe as from the very heads of the sinewes; and thence it is that *Galen* so often repeateth that the Palsie hapneth when the heads of the sinewes are eyther obstructed or resolued. Thus *Rondeletius* hath it in his chap. of the Palsie. *Laurentius* thus: All Anatomistes haue hitherto beene ignorant of the originall and propagation of the Nerues of the spinal marrow, for they all thinke that the nerues of the necke come onely from the marrow of the necke; the nerues of the backe from the marrow of the backe, and of the Loynes from the marrow of the Loynes. But how miserably they haue bin mistaken, is conuincd by a new and vnheard of obseruation of mine owne. Separate therefore the marrow from the rack-bones but keepe it whole, then take from it both the Membranes wherewith it is compassed, cast it into water and shake it a little, and you shall perceiue that the whole marrow from the top to the bottome is made of innumerable furdles and filaments, like a Horse taylor composed of infinite hayres; and that the nerues of os *sacrum* do arise from the same beginning with the nerues that are aboue. This new and admirable obseruation maketh plaine an obscure probleme, why, when the marrow of the necke is offended the motion of the thigh is sometimes taken away, when as the motion of the armes and of the Chest is not at all vitiated; thus for *Laurentius*. To conclude.

The vse of the spinal marrow properly so called, is saith *Galen* in his twelfth Book *de usu partium*, that from it as from another braine there should proceed many nerues as it were small riuers which might conuey the Animall faculty, sense, motion and the Animall spirit; which they receiue by continuation from the braine (to the parts vnder the head) excepting those whereto are transmitted certaine propagations from the sixt paire [tab. 17, fig. 1, and 2, e] of the marrow of the braine, which also are disseminated through the middle and lower bellies. For, because it was not safe, in consideration of the length of the way, that all the nerues should bee transported vnto the inferior parts from the marrow of the braine contained in the Scull; and yet it was necessary that those inferior parts should be supplied with voluntary motion and sence to apprehend annoyances: it was most requisite that from this marrow, as from the braine elongated or produced, those sinewes should be deriued; for if a man had wanted motion hee had beene more like an Image then a creature. And thus much of the vse of the marrow properly so called. But if you take it in the larger signification, then the vse of it is, that from it where it is included within the scull on both sides should yssue seauen coniugations or payres of nerues, (as is commonly thought) we say eight, which are called the nerues of the braine, [tab. 15, fig. 20, BGHIKMNO] together with the Organs of smelling. [Tab. 14, fig. 19, D E] But as it consisteth in the spine without the Scull there are produced therefrom thirty paire [tab. 16, fig. 1] euen all the nerues that passe through the whole body. And thus much of both the braines and spinall marrow, now it followeth that we should intreat of the nerues yssuing therefrom.

CHAP. XVI.

Of the Nerues of the Braine, and first, of the Organs of smelling, called processus Mammillares.

THE Nature of the Braine, the After-braine and the Spinall Marrow being thus manifested, it remaineth that we should speake of the Nerues proceeding from each of them; and first of the Nerues of the braine. Whereas therefore there are five outward senses, the Sight, the Smell, the Hearing, the Taste and the Touching, which from the Braine it selfe or rather from the Marrow thereof doe receiue by nerues as it were by Channels some of them the faculty of Sensation alone, some of them of Sensation and motion together, which nerues are sayed thence to arise as from a principle of dispensation and radiation, from whence they bring the Sensatiue and mouing faculties of the Soule to the instruments of the Sences: it is very fit that in this place we should deliuer their history. Wee will therefore begin with the Organs of smelling. Although the Nose bee the way and path of smells, yet is not the instrument of smelling, neither yet his hindmost coate; but farther within the skull there are certaine processes or productions esteemed for the very organs of this sence, which the Anatomists looking onely vpon their prominent part haue called Pro-

Table 17, Figure 1, Sheweth the Basis of the Braine and After-braine freed from their membrane, that the originall of the Nerves of the braine might be better perceived. Figure 2. Sheweth one side of the Braine, the After-braine, the spinall marrow and the Nerves.

TABVL A. XVII.

FIG. I.

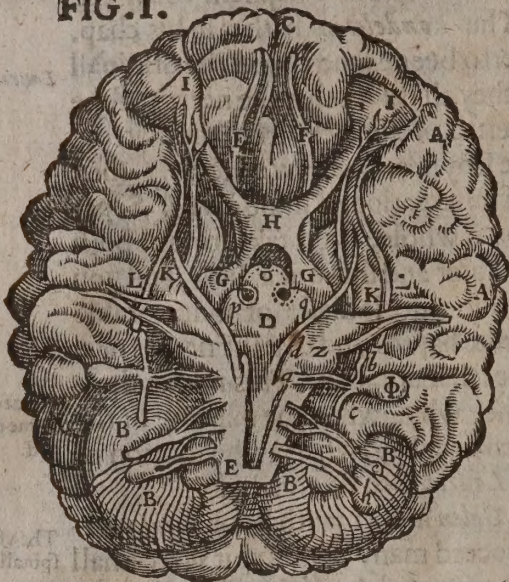


FIG. II.



may be accounted for a distinct nerve. *b* 1, 2, a small branch deriued from this harder part of the first paire. *c* 1, 2, a lower branch from the same originall. *d* 1, 2, this nerve is commonly ascribed to the sixth payre, but indeed is a distinct coniugation which we will call the Eight, because we would not interrupt the order of other mens accounts. *e* 1, 2, the sixth paire of sinewes. *f* 2, a branch from them deriued to the necke and the muscles couched thereupon. *g* 2, another branch to the muscles of the larynx or throtle. *h* 1, 2, the seuenth paire of sinewes. *i* 1, the vnion of the seuenth paire with the sixt. *l* 2, a propagation of the seauenth paire to those muscles which arise from the appendix called *Styloides*. *m* 2, Surcles from the seauenth coniugation to the muscles of the tongue, the bone *Hyois* and the Larynx. *opq* 1, three holes; through the hole *o* the phlegme yssueth out of the third ventricle of the braine to the Tunnell, and at *pq* is the passage of the *soporary* arteries to the ventricles of the braine.

cessus mammillares, and some the organs of smelling. Vnder which Title *Galen* hath written of them at large. These are two something like nerves but scituated in the Basis of the braine; they are whiter, softer & broder then nerves are. Notwithstanding like nerves they are round and slender. In men they are very small; in beastes as Oxen, Goates, Sheepe and Dogs, they are much larger, whence it is that all these Creatures haue this sence of smelling more exquisite then men.

These processes arising out of the marrowey substance of the braine in his Basis [tab. 17, fig. 1, and 2 F. tab. 14, fig. 19. D P] neare the opticke nerves [tab. 17, fig. 1, 2. G] do passe betwixt the braine, (whereto they are tyed by the mediation of the *pia mater*) the wedge bone & the bone

Why beastes
snell better
then men.
Their origi-
nall.

AA 1, 2. The braine.

BB 1, 2. The After-braine.

CC 1, 2, the swelling of the braine which some call the mammillary processes.

D 1, the beginning of the spinall marrow out of the Basis of the braine.

E 1, 2, a part of the spinall marrow when it is ready to yssue out of the skull.

FF 1, 2, the mammillary processes which serue for the sence of Smelling.

GG 1, 2, the opticke nerves.

H 1, the coition or vnion of the opticke nerves.

II 1, 2, the coate of the eye whereinto the optick nerve is extended.

KK 1, 2, the second paire of the sinewes, ordained for the motion of the eyes.

LL 1, 2, the third paire of sinewes, or according to the most Anatomists, the lesser roote of the third paire.

MM 1, 2, the fourth paire of sinewes, or the greater roote of the third paire.

N 2, a branch of the third coniugation deriued to the musculous skin of the forehead.

O 2, a branch of the same to the vpper iaw.

PP 2, another into the coate of the nosethrills.

Q 2, another into the temporall muscles.

R 2, a branch of the fourth coniugation crumpled like the tendrill of a vine.

S 2, a branch of the same reaching vnto the vpper teeth and the gummies.

T 2, another of the same to the lower iaw.

V 2, a Scurcle of the branch *T*, to the lower lip.

XX 2, another surcle from the branch *T*, to the rootes of the lower teeth.

YY 2, the assumption of the nerves of the fourth coniugation vnto the coate of the tongue.

Z 1, 2, the fourth paire vulgarly so called which are spent into the coates of the palat.

a 1, 2, the fift paire of sinewes which belong to the hearing.

q, the Auditory nerve spread abroad into the cavity of the stony bone. * a hard part of the fift coniugation about the * which

bone of the forehead vnto the *Sinus* or cauities of the spongy bone, [tab. 14, fig. 19, HF] which cauities are couered with the *dura meninx* diuersly perforated and are made to receiue these productions. To each of these processes saith *Fallopins* reacheth a manifest hole from the ventricle, from which hole the passage is open to the spongy bone. This passage in a man is very narrow, so that it cannot be discerned, but when the head is very greene or new. In Oxen it is very large. Through these passages and productions aire & vapors attracted or drawne in respiration through the nostrils as it were by pipes and channels, are carried vnto the brain that it might iudge of odoriferous objects. *Varolius* is of opinion that from these productions there is no free passage vnto the ventricles themselves; although *Fallopins* was vicerly of another minde. They are like to nerves in their passage, colour and vse, and therefore do well deserue to be called the *Nerves of smelling* as *Archangelus* stileth them. But *Vesalius* counteth them to be the first paire or coniugation of the braine, yet because they neuer attaine through the thicke membrane and cauity of the skull, neither haue as other nerves any propagations deriued from them: therefore neither *Herophilus* nor *Marinus* nor *Galen* himselte, nor many amongst the *Neotericks* or new writers haue vouchsafed them the name of nerves; wee stand not vpon words and therefore passe from them vnto the nerves of the eies.

Their vse.

How they may be called nerves.

CHAP. XVII.

Of the nerves of the Eies, or of the first and second Coniugations.

¶ Lbeit in a particular discourse hereafter following wee intend more districly and carefully to prosecute the Nature and diuarcations of nerves in generall and euery one in particular; yet because all the nerves of the head haue their originall from diuers partes of the substance of the same: Wee cannot chuse in this place but make some mention of them though it be the briefer.

The first coniugation therefore of the nerves of the braine are the Opticks, [Table 15, fig. 7 1, and 2, G] larger and softer then all other simple nerves. Larger because they bee sensibly perforated, softer because they arise out of the Center of the Basis, whence proceeding forward with a slow course they are vnited aboue the saddle of the wedge-bone [Tab. 17, fig. 1, H, table 14, fig. 19, O] and so make a common body. After being againe separated [tab. 14, fig. 19, MN, tab. 17, fig. 1, aboue H] they passe obliquely forward through their proper holes [table 4, fig. 10, B] the one to the Center of the right eye, the other to the Center of the left [tab. 3, lib. 8, fig. 8, a, or together with the membrane fig. 2, a b c.]

The opticke nerves.

They consist of a double substance, the one marrowey the other membranous. The marrowey is soft like the substance of the braine, which you shall perceiue to yssue if it bee hard pressed, and of this marrowey substance dilated in the orbe of the eye is that coat made which of the similitude of a net is called *Retina tunica* [Tab. 17, fig. 1, and 2, I] and this compasseth the glassy humour like a spheare

Their double substance. Marrowey.

They haue two membranes from the two Meninges of the braine. The thinne membrane inuesteth them frō their original to their out-let from the skull; the thicke Meninx is added to them, from thence to the eye; and so the thicke membrane degenerateth into the horny coat, the thinne is consumed or spent in the *Vnea*, & so the Animall spirit is transported through the continuation of this nerve vnto the *pupilla* or Apple, which is the hole of the grapy membrane.

Their membranes.

They are called therefore Opticke nerves from their action, because they communicate to the eye the sence of seeing.

The second coniugation is of the nerves which moue the eyes, [tab. 18, fig. 1, and 2 K, tab. 15, fig. 20, G] which is distinguished from the former onely by a little and thin bone, & riseth from the the Basis of the braine [tab. 25, fig. 1, e] a little behinde the former as *Vesalius* saith. This paire is smaller and slenderer by much then is the opticke, as also harder because it was to be inserted into the muscles. It yssueth by a proper hole of his owne [tab. 4, fig. 10, G] which is the second of the wedge-bone, where after it is diuided into notable branches which are sent into the muscles. In some bodies (though it be but seldom) they send small twigs to the temporall muscles; whence it is that sometimes if that muscle be offended, the eie also suffereth with it, and so on the contrary.

The 2. coniugation of the mouing nerves. Their frame.

Note this.

Their vse is to afford to the muscles the facultie of Motion, as also a drawing power to their membranes. Now the reason why when one eie is moued to the side the other also necessarily followeth, is, because these nerves are continued one with another in their originall.

Their vse. Why both eies moue together.

CHAP. XVIII.

Of the third and fourth Coniugations of the Nerves of the Braine.

The 3. Coniugation,



HE third Coniugation [tab. 19, fig. 1, and 2, L. tab. 15, fig. 20, H] is sent vnto the Muscles of the face, and is commonly called the smaller roote of the third paire, but it deserueth, wee thinke, to bee a particular coniugation, because it is not ioyned with the following paire [tab. 15, fig. 20, I. tab. 19, fig. 1 and 2, L. with M] neyther in his beginning nor in his progresse.

His Original,

Issue,

4. Branches.

It ariseth from the lower and backer part of the marrow of the Braine. It is very small and perforateth the *dura Meninx* at the side of the basis of the Braine where it is fastned to the second coniugation [table 19, Fig. 1, K] and so with it yssueth into the orbe of the eye by the hole common to them both [tab. 3, Fig. 8, G] Then it is diuided into foure branches: the first [tab. 19, Fig. 2, N] ascendeth vpward by the fat of the eye and yssueth at a hole of the forehead bone proper vnto it [tab. 3, Fig. 8, A] and so passeth into the skinne of the Forehead to which it giueth motion, as also to the vpper eye-brow.

The second descendeth [tab. 19, Fig. 2, O] and passeth through a hole of his owne, bored in the fourth bone of the vpper law [tab. 3, Fig. 8, B] and so is dispersed into the Muscles of the vpper lip, into those that mooue the wing of the Nose outward, into the tip it selfe and some of the gummies.

The third branch [table 19, Fig. 2, P] passeth through the second hole of the vpper law [tab. 3, Fig. 8, C] and attaineth into the Cavity of the Nosthilles and is spent into their coate, [table 19, Fig. 2, the lower P] and affordeth a small surcle to the membranous Muscle which contracteth the wing of the nose.

The fourth branch [tab. 19, Fig. 2, Q] being led through the Fissure which is betwixt the bone of the vpper law and the Wedge-bone [tab. 3, Fig. 8, D] is spent into the inner part of the temporall muscles.

The fourth Coniugation,

The reason of his originall.

The Fourth Coniugation are the Nerves of Tasting, Tab. 19, Fig. 1, and 2. M. Tab. 15, Fig. 20, I] it beareth on the former in his progresse but not in his originall. It proceedeth not out of the backparts of the braine because they are hard; not out of the sides because their way would not haue bin safe; but out of the basis yea the very Marrow of the Braine [tab. 25, fig. 1, char. 3] aswell for security as because of the Situation of the tongue.

Where it yssueth.

It hath three branches.

It yssueth at the first hole of the wedge-bone [tab. 3, fig. 9, Q] and presently sendeth a Surcle out of it like the crumpled Tendrill of a Vine, in which the Animall spirit maketh some stay. Afterwards, it is by two branches vnited to the Nerue of Hearing, [tab. 19, fig. 1, 2, bc] & so is disseminated into the muscles of the face, the Temporall, the grinding Muscles of the Cheekes and to the skinne of the face.

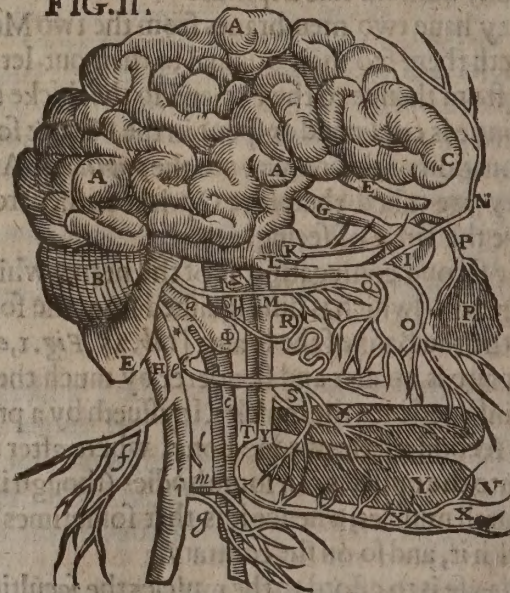
A second branch it also parteth with [tab. 19, fig. 2, S] which affordeth surcles to that part of the Gummies wherein the grinding Teeth are fastened, yea vnto the teeth themselues.

TABVLA. XIX.

FIG. I.



FIG. II.



A third branch also sprowteth out of the back-part, [table 19, Fig. 2, T] which is inserted into the muscles that lurketh within the mouth, and passeth through the inner hole [tab. 11, lib. 8, fig. 2, F] of the lower Jaw, and there offereth surcles to the Rootes of the lower teeth of the same side. [table 19, Fig. 2, XX] and by their helpe the teeth haue sense, whereas the other bones haue none.

How the teeth haue sense.

Finally, the Trunke it selfe [table 19, Fig. 2, T] passing through the muscles lurking in the mouth together with the Trunke of the other side attaine to the sides of the tongue and are consumed in his coate to make it a conuenient Organ of Gustation.

CHAP. XIX.

Of the Nerues of hearing, or of the first Coniugation of the Braine.

THE first Coniugation [Table 20, Fig. 1, and 2, Tab. 15, Fig. 20, M] ariseth out of the Marrow of the Braine lengthened, where it ioyneth with the *Cerebellum*. [Tab. 25, Fig. 1, i] There his originall seemeth to be out of two Surcles or Nerues, the one softer the other harder, which together perforate the membrane and passe to the stony bone.

The first Coniugation.

His 2. Surcles.

His out-gate.

This Nerue passeth through a notable writhen hole thrilled in the stony-bone, which they call the first hole of the Temple bone, where it meeteth with that cavity which is compared to a Connyborough and prepared for the Organ of hearing. Afterward the harder part falleth into the cavity where the *Tympanum* or the Drum is placed.

The softer part [Table 20, Fig. 2, a] which is indeed *Nervus auditorius* the sinew of hearing, accompanieth the former, and when it attaineth to the extremity of the aboue named cavity it is dilated like a membrane [tab. 20, Fig. 1, 2, d] and becommeth the speciall Instrument of hearing, and in that place remaineth haply after the same manner that wee said before the Organ of smelling was extended.

The true Organ of hearing.

CHAP. XX.

Of the sixt, seauenth, and eight Coniugations of the Sinewes.

THE sixt Coniugation [tab. 21, fig. 1, and 2, e, tab. 15, fig. 20, N] taketh his beginning of a few fibres a little below the originall of the Nerue of hearing.

That the sixt Coniugation is not one but two Nerues.

These Nerues being instantly vnited doe make one notable Nerue as some haue thought, but indeed they are neuer so vnited but that they remaine two Nerues contained or held together in one membrane, and passe out at one hole, [tab. 4, Fig. 10, b] which is counted the 1. hole of the *Occipitium* or Nowle-bone. The one of those is the forwarder and the lesser: the other the backwarder and the greater. The lesser runneth directly to the muscles of the tongue, and for the most part is spent in the mouth; the greater as soone as it is issued out of the Skull sendeth a branch backward [tab. 21, fig. 2, f] which is diuersly distributed into the *Muncks-hood* muscle of the shoulder blade. The trunke it selfe descending is tyed to the seauenth Coniugation, [tab. 21, Fig. 2, H] and at the sides of the throttle is increased with a branch from that seauenth Coniugation, [table 21, fig. 2, i] with which notwithstanding it is not mingled but onely colligated or tyed: after it sendeth surcles to the muscles of the *Larinx* or throtle, [tab. 21, Fig. 2, g] as also some other smaller to the muscles of the Chops, thence it descendeth to the Chest, where wee will leaue it till another time.

where it issueth.

The course of it.

The seauenth Coniugation [table 21, Fig. 1, h Fig. 2, H] moues the tongue, and is the hardest of all the sinewes proceeding out of the Scull, for it ariseth iust at the place where the marrow of the braine falleth out of the Scull. [tab. 21, Fig. 1, 2, E] It ariseth of many Roots somewhat distant each from other, which ioyning together into one doe passe out of the Scull at an oblique hole bored in the bone of the *Occipitium*, and for more security is ioyned by strong membranes with the sixt Coniugation, yet not mingled therewith. For this seauenth paire keepeth his owne body and so runneth downward to the roots of the tongue, where the most part of it [tab. 21, Fig. 2, Z] is loosened into many fibres which giue motion thereto. Other parts of it are deriued to the muscles of the bone *Hyois* and the Throtle to giue them motion;

The seauenth Coniugation.

His originall.

and course.

motion; some surcles also it sendeth [Tab. 21, fig. 2, 4] to those muscles that arise from the appendix called Styloides.

The eight
Coniugation,

The eight Coniugation [Tab. 21, fig. 1, 2, d, Tab. 15, fig. 10, L] proceedeth out of the marrow of the braine above the Auditory Nerue betwixt the second and third Coniugations.

It perforateth betwixt those 2. paires the thicke Meninx and attayneth into the orbe of the eye through the hole that belongeth to the second coniugation, and is almost wholly spent into that muscle of the eye which draweth it vnto the vter corner.

CHAP. XXI.

Of the Nerves proceeding from the spinall marrow properly so called.

Auing acquainted you with those coniugations of finewes which belong vnto any part of the braine or his productions containd within the Skull, it remaineth now to give you a short viewe of those nerves which are deriued out of the spinall marrow containd in the rack-bones of the Chine. These therefore are accounted to bee 30. paires, all proceeding out of distinct the seuerall parts; that is to say, out of the racks of the neck, the chest, the loines and the holy-bone.

Seauen or 8.
paires of the
Necke.

The Coniugations of the Necke some account seauen, others eight, dispersed into the outside of the whole head and the muscles thereof.

The first Coniugation yssueth betweene the Occipitium or Nowle bone and the first rack-bone, and is diuided into two little branches, a forward and lesser, [Tab. 22, H] and a backward and greater [Tab. 23, F].

The second Coniugation of the Necke hath two originals, a forward [Tab. 22, N] and a backward which is the larger, [Table 23, I] which is diuided into two branches, a thicker [Table 23, K] and a thinner, [Tab. 23, above B].

The 3. paire [Tab. 22, character 3] breaketh out of the common hole betweene the second and the third spondels or racks, and is diuided into two branches, one forward [Tab. 22, P] which is subdivided into foure Surcles. The first at [Tab. 22, Q] The second at [Tab. 22, and 23, R.] The third at [Table 22, S and Table 23, KL] The fourth at [Tab. 22, and 23, T.] Another backward, [Tab. 22, and 23, O] diffeminated into the muscles which are common to the head and the necke.

The fourth Coniugation [Tab. 21, Char. 4] falleth out of the common hole of the third and fourth vertebra, and is diuided into two branches, the first forward and greater, [Tab. 22, and 23, X] which is diuided into three Surcles, the first at Tab. 22, y] the second at Tab. 22, a] the third at Tab. 22, b] The second branch is the lesser and more backward, [Tab. 22, and 23, v] and is spent in the muscles of the Necke and the membranous muscles of the Cheekes.

The fift Coniugation [Tab. 22, char. 5] falleth out vnder the fourth rack-bone, and is diuided into two branches, one forward and another backward, the forward [Tab. 22, and 23, d] hath three Surcles, the first at Tab. 22, a d] the second Tab. 22, e] the third Tab. 22, and 23, f] The backward branch [Tab. 23, a] is distributed as is the backward branch of the fourth paire.

The sixt Coniugation [Tab. 22, char. 6] falleth out vnder the fift racke, and is likewise diuided into a fore and hinder branch: the fore branch at Tab. 22, f] the hinder branch at Tab. 23, k.]

The seuenth Coniugation [Tab. 22, char. 7] yssueth vnder the sixt racke bone of the Necke, and is ioyned with the sixt paire of the Necke and the first of the Chest [Tab. 22, f.] for more security, and the greatest part of it passeth into the arme, which sometimes sendeth a branch to accomplish the Nerue of the Midriff. The backer branch [Tab. 23, e] is the lesse, and is bestowed vpon the muscles lying vpon the necke and vpon the square muscle of the Cheeke, which first suffereth convulsion in the disease called *Spasmus Cynicus*, or the Dog laughter.

Twelve paire
of the Chest.

And thus much of the Nerves proceeding from the spinall marrow contained within the vertebra or spondels of the necke, which we sayde were seauen Coniugations. It followeth now that we should intreate of the nerves proceeding from the marrow of the rack bones of the Thorax or Chest. Of these, there are (as some thinke) but cleauen Coniugations, others resolue of twelue, all which after their outlet are diuided into two branches, one greater, the other lesser, one passing forward, another reflected backward.

The first Coniugation [Table 22, character 8] is shewed betwixt the seuenth bone of the Necke and the first of the Chest. It hath two branches, the first greater sendeth certaine pro-
paga-

pagations to the shoulder blade [*table 13, aa*] and to the first rib: [*tab. 22, y*] The second lesser [*table 23, u*] is disseminated into the adjoining muscles.

The second Coniugation [*tab. 23, char. 9*] yssueth betwixt the first and second bone of the Chest; then it distributeth a branch backward, [*tab. 23, b*] & after is ioyned with a branch of the former Coniugation, [*tab. 23, f*] & so passeth into the arme; that which remaineth of this Coniugation followeth the course of the first rib, and maketh an intercostall Nerue.

The third Coniugation as also all the other nine [*table 22, from char. 10, to 20*] of the Chest are distributed after the same manner. For after they fall out of the sides of the *vertebra* they are diuided into two branches, one forward and another backward; the forward branches are called Intercostales, that is, *betwixt the ribbes*, [*table 22, m*] for from them many branches are disseminated into the Intercostall muscles, [*table 22, 00*] and the characters of the left side into the muscles lying vpon the Chest, [*table 22, 00, 11, n*] as the great and lesser *Saw*, the pectorall and the broad Muscle; [*table 22, mu*] and are strangely reflected to the vessels thereabout. The backward branches leane backward to the spines or sharpe points of the *vertebra*, and are deriued into the muscles which moue the backe of the Chest, and into the skinne of the backe, but their distribution is not in all men alike.

The third and all the rest.

Finally, the two last coniugations of the twelue do send Surcles [*Tab. 22, at the sides of the 18, and 19. Characters*] to the head of the sixt muscle of the thigh.

From the spinall marrow contained in the racks of the loynes doe arise five coniugations greater then the former, deuided like-wise after their out-gate into a forward and a backward branch, and from their backward branches [*Table 23, char. 52, and 53*] send surcles into the muscles which grow to the *vertebra* of the Loynes.

The nerves of the Loynes, five paire.

The first Coniugation [*Table 22, char. 20*] as also al the rest yssue out of the holes of the *vertebra* vnder the *Peritonaeum*, and is diuided into two branches, a greater and *anterior* partly ascending to the *Diaphragma*, partly to the muscles of the *Abdomen* or paunch; and a lesser and *posterior* which is reflected into the muscles which leane vpon the *vertebra* of the Loynes.

The second Coniugation [*table 22, char. 21*] runneth vnder the sixt muscle of the thighe and riseth to the top of the haunch bone, but the forward branch is distributed to the sixth internall Iliacke, and the first bender of the legge. It sendeth also a small long nerue [*table 22, char. 49*] accompanying the spermaticall vessels of the same side euen vnto the Testicle.

The third coniugation [*table 22, char. 22*] yssueth also vnder the Lumball muscle; the fore-branch passeth neare the haunch-bone and is deuided into two propagations, one going to the knee the other accompanying the veine called *Saphena*; but the back branch is reflected and disseminated into the muscles lying vpon the loynes and into the skinne. So likewise from all the foure-branches of the three first coniugations certaine shootes [*table 22, at the sides of the 20, 21, 22. Characters*] doe attaine to the costall nerue, and are ioyned therewith.

The fourth coniugation [*table 22, char. 23*] which is the biggest of all the coniugations of the loynes accompanieth the veines and arteries to the groine, and distributeth certaine surcles to the forward muscles of the thigh and the leg.

The fift coniugation [*table 22, char. 24*] is parted in twaine as are the former. The fore-branch and the greater passeth through a hole betwixt the *Coxa*, the share-bone & the branch-bone and sendeth diuers shootes to the muscles of the thigh, the yarde, the necke of the wombe also and the bladder; but the backe-branch is reflected to the muscles that leane vpon the *vertebra* of the loynes and into the skin thereabouts. Furthermore, these coniugations are tyed one vnto another, the first to the second, the second to the third, the third with the fourth, and the fourth with the fift, as is shewed in the first figure of the 22. Table.

To conclude, out of the marrow conteyned in the *vertebra* of the *Os sacrum* or holy-bone do proceed sixe coniugations.

The nerves of the Os sacrum.

The first [*table 22, char. 25*] yssueth betwixt the last of the loyne and the first racke of the holy-bone, and is diuided into a fore-branch and a hind-branch; the fore-branch sendeth a surcle [*table 22, character 23*] into the inside of the haunch-bone, from which certaine shootes are offered to the muscles of the *Abdomen*, and the seuenth muscle of the thigh. The backe-branch passeth in a like course as do the back-branches of the other coniugations and a shoot beside into the muscles [*table 23, char. 54*] produced from the haunch-bone, specially into the first mouing the thigh, from whence it is consumed into the skin.

The five other Coniugations [*table 22, from the 26. to the 30. charact.*] are produced after another manner; for before they yssue they are double on either side; one proceeding forward and another backward. Of the fore-branches the three vppermost runne to the legge, the

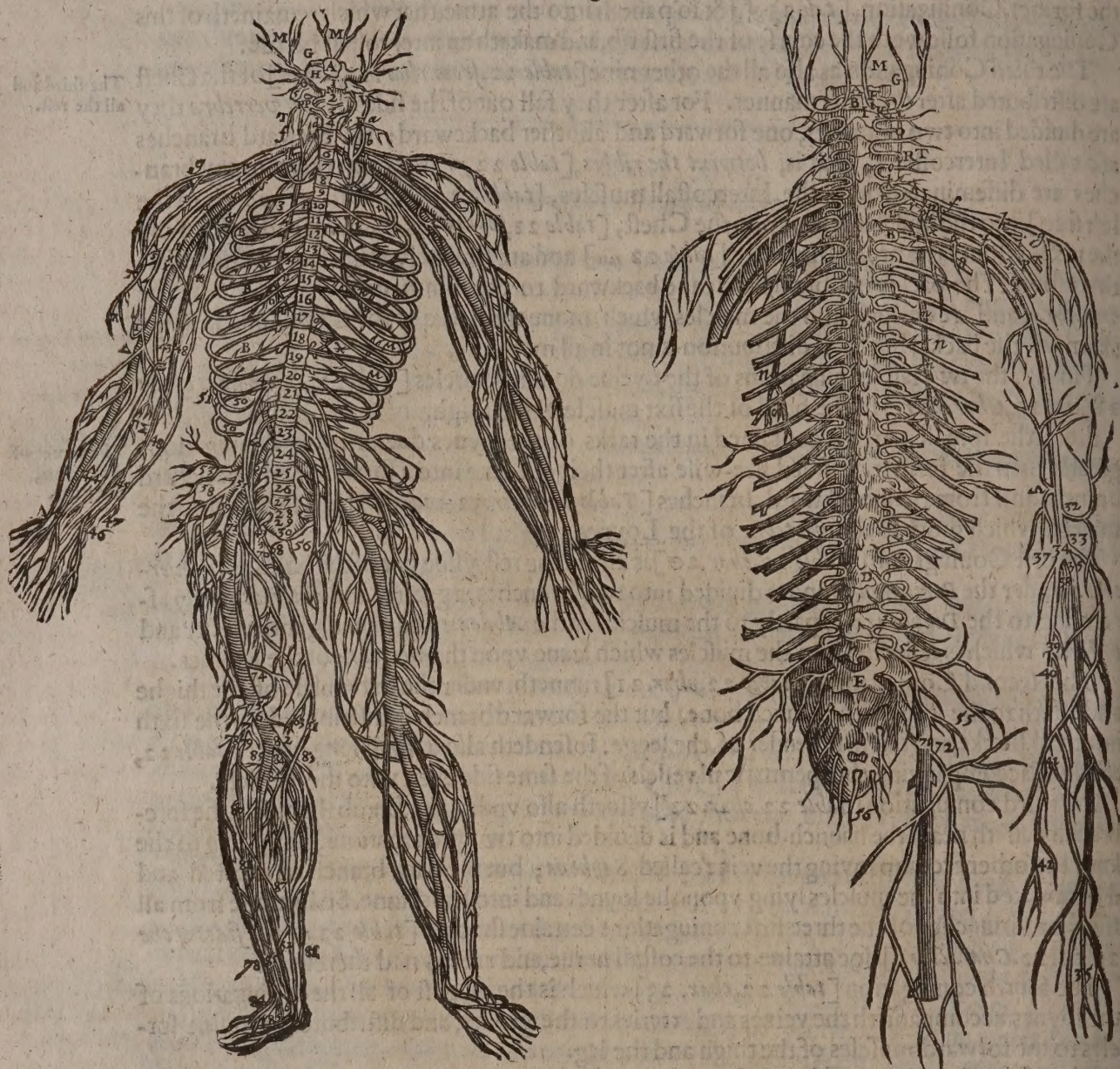
The other five.

Table 22. and Table 23. Because the same Characters belong to them both, we have set them together.

Table 22. sheweth the Racks of the spine and the nerves yssuing there from on the fore side.

Table 23. sheweth the same Racks and Nerves on the back side.

TABVLA XXII. & XXIII.



A 1, 2. The spinall marrow as it goeth into the racke-bones. *BC 2.* The seaven vertebrae or racke-bones of the necke: Character from 1, 2, to 30. in the 15. table do shew the racks of the whole spine. *CD 2.* amongst these the twelue racks of the Chest. *DE 2.* The five Racks of the Loynes. *E 2.* The holy bone. *F 2.* the hinder branch of the first coniugation of sinewes. *G 1, 2.* the distribution of the same branch into the muscles of the head. *H 1,* the foreward branch of the first coniugation. *I 2,* a small branch of the hinder propagation of the second paire which is distributed vpward. *K,* a thicker branch of the same nerve. *L 2,* the coition or coniunction of the branch of the third paire, with the branch of the second paire marked with *K.* *MM 1, 2,* the second paire distributed vnto the skinne of the head as farre as to the necke. *N 1.* The anterior branch of the second paire. Character 3. in the first Table sheweth the third coniugation and the third rack-bone. *O 1, 2.* The hinder branch of the third paire reflected first backward, then forward vnto the muscles: and such a reflection there is in all the nerves vnto Character 24. *P 1.* the anterior branch of the third paire parted into foure. *Q 1,* the first going vnto the muscles. *R 1, 2.* The second ioyning with the fourth paire. *S 1,* The third commixed with the branch *K.* *T 1, 2.* The fourth branch going to the muscles of that place. Character 4. in 1, the fourth coniugation of the fourth rack-bone. *V 1, 2.* The Posterior branch of the 4. paire. *X 1, 2.* The anterior branch of the 4. paire parted into three. *Y 1.* The first admitting the branch *R.* *a 1,* the second going to the muscles. *b 1,* the 3. reaching to a part of the first paire marked with *e.* Character 5. in 1, the 5. paire. *c 2,* the posterior branch of the 5. payre. *d 1, 2,* the anterior branch of the 5. paire. *e 1,* this portion maketh the nerue of the midriffe. *f 1, 2,* a branch of the nerue *d* creeping along the top of the shoulder, vnder which are certaine surcles attaining to the shoulder-blade. *g 1, 2,* a surcle of the nerue *f* deriued to the skin on the top of the shoulder. *h 1, 2* a surcle of the nerue *f* going to the second muscle of the arme. *i 1, 2,* another branch inserted into the same muscle and the skin. Character 6. in 1, the sixt paire. *k 2,* the posterior branch of the same sixt coniugation. *l 1,* the anterior branch of the same coniugation. *m 1,* a surcle of the same nerue appointed to make vp the Sinew of the midriffe. *n 1, 2,* the nerue of the midriffe made of three surcles. *b, b,* and *m.* *oo 1, 2,* the insertion of

of this nerve into the midriffe. *p. 2*, A branch of the sixth coniugation running to the cavity of the shoulder blade. *q. 1, 2* The coniugation or implication of the branch *l*, with the branches neighbouring about it. Char. 7. in 1, The 7. coniugation of sinews. *r. 2*, The *Posterior* branch of the 7. paire. *s. 1*, The congresse or meeting of the 7. coniugation with the branches that are neere it. *tt. 2*, Surcles of this nerve deriued to the muscles of the shoulder blade and the arme. Char. 8. in 1, The 8. coniugation or the first paire of the Chest running about the first rackbone of the Chest. *u. 2*, The *posterior* branch of the 8. paire. *x. 1, 2*, The coition or coniugation of the 8. paire with the 7. *y. 1*, A branch of the 8. paire reaching to the top of the breast. *aa. 2*, Surcles proceeding from the 8. coniugation and deriued to the muscles in this place. char. 9. in 1, The 9. paire of nerves. *β. 2*, The *Posterior* branch of the 9. paire. *δ. 1*, The *anterior* branch of the same coniugation. *ζ. 1*, Surcles from this branch to the distances or spaces of the Chest. Char. 10. to 20. in 1, The paires of sinews deriued to the distances betwixt the ribs. *nn. 1*, Surcles of the intercostall sinews going to the roots of the ribs and increasing the *Costal* nerves. *θ θ. 1*, Branches from the intercostall sinews deriued vnto the muscles which lye vpon the Chest. *11. 1*, Branches going to the pectorall muscle or the first muscle of the arme. *κ κ. 1*, Other branches going to the lower side of the same muscle. *λ λ. 1*, Branches going to the oblique muscles of the *Abdomen*. *μ μ. 1*, Others deriued to that muscle of the arme which is called *Latissimus*. *ν. 1*, A branch passing vnto the *Pap. o o. 1*, Branches from 18. and 19. to the beginning of that muscle of the thigh which is called *Lumbalis* or the sixth muscle of the thigh. *π π. 1*, The first nerve of the arme distributed into the skin. *ρ. 1, 2*, The second nerve of the arme. *σ σ. 1*, From this doe nerves passe to the first muscle of the cubite called *Biceps*. *τ. 1, 2*, The third nerve of the arme. *υ. 1, 2*, A branch of the same going to the skin of the arme. *φ. 1*, A small branch deriued to the second muscle of the cubite called *Brachialis*. *χ. 1*, Others passing to the skin on the fore side of the arme. *ψ. 1*, The congresse or coniugation of the third nerve with the second. *ω. 1*, The 2. and the 3. nerves after their coniugation doe heere creepe downeward. *1. 1*, a nerve deriued vnto the second muscle of the *Radius* which muscle is called *supinator longior*. *Δ Δ. 1*, The vpper branch of the 2. nerve, running to the wrist and to the first joint of the thumbe. *Θ. 1*, The middle branch of the 2. nerve. *Α. 1*, The progresse of the same euen vnto the hand. *Ξ. 1*, The lower branch of the 2. nerve. *Π Σ. 1*, Two branches of the same nerve going to the inside of the hand. *Φ. 1, 2*, The 4. nerve of the arme. *τ. 2*, From hence do proceede nerves to the muscles which extend or stretch out the cubite. *Ω. 2*, A branch going to the skin of the arme on the backside. *32. 2*, Branches deriued to the outward skin of the arme. *34. 2*, The by partition of the fourth nerve at the cubite. *33. 2*, A branch creeping along the outside of the cubite euen vnto the wrist. *35. 2*, The vpper branch of the foresaide diuision. *36. 2*, Surcles belonging to the thumbe, the forefinger and the middle finger on their out sides. *37. 2*, The lower branch of the foresaide diuision. *38. 2*, Surcles heerefrom to the muscles arising out of the externall bunch of the shoulder bone. *39. 40. 41. 2*, Three branches going to the muscles which spring from the bone called *Vlna*. *42. 2*, The end of the branch, *37*. neere the joint of the wrist. **. 1, 2*, The fift nerve of the arme. *43. 1*, Surcles of the 3. and 5. nerves to the inside of the cubite. *44. 1*, A branch of the 3. nerve going to the palme of the hand and the fingers. *45. 1*, A branch of the 5. nerve to the inside of the hand. *46. 1*, A surcle of the branch *45*, led to the outside of the hand. *8. 1, 2*, The 6. nerve of the arme. *47. 1*, The end thereof next the joint. *48. 48. 1*, Surcles from the 6. nerve vnto the skin. Char. 20. to 24. 1, Nerves proceeding out of the racks of the loynes. *49. 49. 1*, A branch going into the Testicles from the 20. paire. *50. 50. 1*, The nerves belonging to the muscles of the *Abdomen*. *51. 1*, Surcles from these to the broad muscle of the arme called *Latissimus*. *52. 52. 2*, The backward branches proceeding out of the racks of the Loynes. Char. 25. to 30. The coniugations or paires of sinews proceeding out of the holy bone. *53. 1*, A branch of the 25. paire going to the inside of the *Coxendix* or hip-bone. *54. 55. 2*, A branch attaining to the outside of the *Coxendix*. **. 2*, Hence proceedeth a nerve communicated to the yard. *56. 2*, The end of the spinall marrow. *57. 1*, The first nerve of the leg. *58. 1*, Branches heerefrom to the skin. *59. 1*, Other branches heerefrom to the muscles. *60. 1*, The 2. nerve of the Leg. *61. 1*, Branches heerefrom to the skin. *62. 1*, A branch descending to the top of the foot. *63. 1*, Branches from *61*. compassing the knee. *64. 1*, A branch of the 2. nerve going to the muscles. *65. 1*, a branch heerefrom going to the 5. muscle of the thigh called *Triceps*. *66. 1*, The nerve of the Leg. *67. 1*, A surcle creeping to the hole of the share-bone. *68. 1*, A branch allowed to the skin on the inside of the thigh. *69. 1*, A portion of the 3. nerve going to the muscles. *70. 1*, A portion hereof communicated to the 2. muscle which bendeth the leg or *Tibia*. *71. 1, 2*, The 4. nerve of the leg. *72. 1, 2*, A branch hereof communicated to the skin of the thigh in the backpart. *73. 1*, Another to the muscles which arise from the *Coxendix*. *74. 1*, A branch allowed to the 4. muscle of the *Tibia* or leg and to the skin. *75. 1*, Surcles from the 4. to the heads of the muscles of the foot. *76. 1*, The diuision of the 4. nerve in the Ham into 2. Trunkes. *77. 1*, The outward trunk. *78. 78. 1*, A branch heerefrom to the skin of the leg or *Tibia* on the outside as farre as to the little toe. *79. 1*, Another branch inserted into the muscles. *80. 1*, A branch dispersed into the skin of the fore side of the leg from the branch. *79. 81. 1*, A part of the branch *79*. going to the muscles of the foot. *82. 1*, The inner trunk of the 4. Nerve. *83. 83. 1*, A branch creeping along the inside of the leg vnder the skin. *84. 1*, A branch of the trunk. *82*. disposed vnder the skin to the back-side of the Calf of the leg. *85. 85. 1*, A branch of the trunk. *82*. creeping along the fore side of the leg to the vpper part of the foot. *86. 1*, A branch of the trunk *82*. passing along the backside of the legge and distributed to the muscles. *87. 1*, The remainder of the inner trunk allowed to the toes.

the two lowermost are diuersly distributed into the muscles of the fundament and the bladder and parts thereabouts. But the back-branches [*tab. 23. char. 54. & 55.*] are distributed into the muscles on the backside of the hanch and holy bones, and into the skin of the buttocks.

Finally, the end of the spinall marrow [*tab. 22. and 23. char. 56.*] proceeding from the holy bone sendeth one propagation on either side, which is sometimes diuersly diuicuated and disseminated into the fourth muscle of the thigh, and the skin betwixt the buttocks and the fundament. Notwithstanding in Dogs and Apes there are three coniugations proceeding out of the Coccyx or rump-bone.

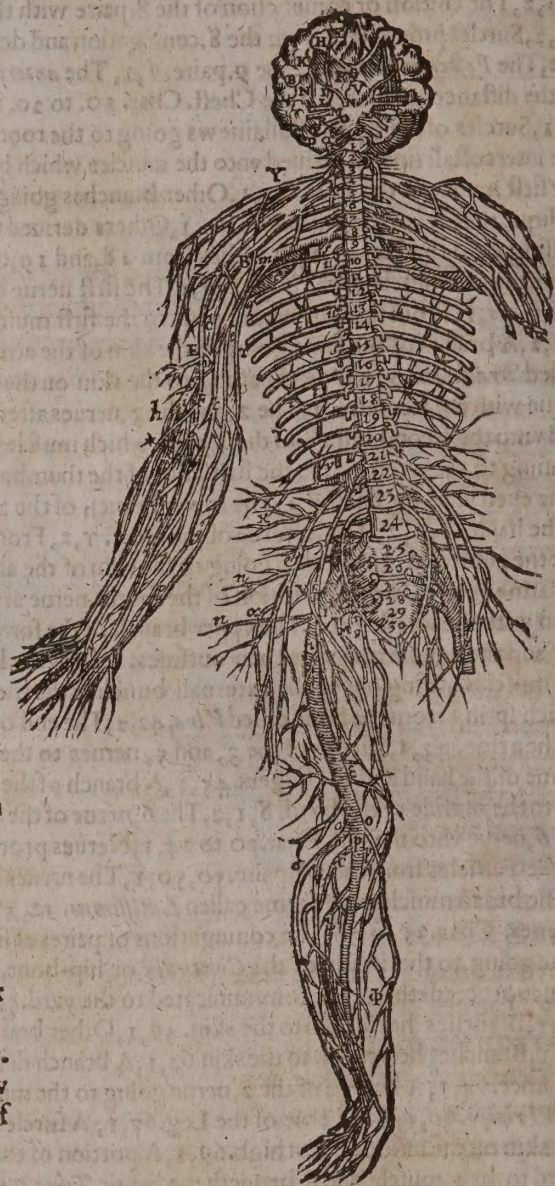
Wherefore to summe vp all, we must remember that the spinall marrow hath 30. paire or coniugations of sinews; seuen belonging to the marrow of the necke, twelue to the marrow of the backe, siue to the marrow of the loynes and six to the marrow of the holy-bone: all

The vse of
this chapter.

Table 24. sheweth the Braine together with the After-braine, the spinall marrow and the Nerves of the whole body.

TABVLA XXIV.

- A, That part of the braine that is next the noſethrills.
 B, That part which is at the ſide of the ventricles.
 C, The back part of the braine.
 D, The *Cerebellum* or After-braine.
 E, The Mammillary proceſſe in the right ſide.
 F, The originall of the opticke nerve.
 G, Their coniunctions.
 H, The coare into which the optick nerve is extended.
 I, The ſecond paire of the ſinews of the braine.
 K, The leſſer roote of the third coniugation. (opinion:
 L, the thick roote of the ſame coniugation according to the common
 M, The fourth coniugation of the ſinews.
 N, The leſſer roote of the fiſt paire.
 O, The bigger roote of the ſame paire.
 P, The ſmall membrane of the eare which they call the *Tympany*.
 Q, The lower branch of the bigger roote of the fiſt coniugation.
 S, The ſixt paire of ſinews.
 T, The ſeuenth paire.
 V, The beginning of the ſpinall marrow out of the middle of the ba-
 ſis of the braine.
 X, The right ſinew of the midriffe cut off.
 Y, A branch from the fiſt paire creeping to the top of the ſhoulder.
 Z, The fiſt nerve of the arme from whence there goeth a branch to
 the ſkin.
 A, The ſecond nerve of the arme, and a branch therefrom into the
 fiſt muſcle of the Cubite.
 B, The third nerve of the arme and a branch going to the ſkin on
 the outſide.
 C, A branch from the 3. nerve to the 2. muſcle of the Cubite.
 D, The congreſſe or meeting of the ſecond nerve with the third.
 E, A ſmall branch from the 3. nerve to the 2. muſcle of the *Radins*.
 F, The diſtribution of the ſecond nerve into two branches.
 * The leſſer branch of this diuiſion lengthened out to the ſkin as far
 as the thumb.
 a, The place of the ſpinall marrow where it iſſueth out of the braine.
 1, 2, 3, &c. Thirty paires of nerves ariſing from the ſpinall marrow
 are here noted by their Char. that is to ſay, 7, of the neck, 12, of
 the Cheſt, 5, of the loynes, and 6, of the holy-bone.
 b, The thicker branch of the 2. nerve diuided into 2. parts.
 c, Branches of the 3. nerve ſprinkled here and there.
 d, Nerves from the third paire to the thumb, the forefinger and the middle finger. ee, The 4. nerve of the arme. f, The paſ-
 ſage hereof through the inſide of the ſhoulder. g, A tripartition of this branch where it toucheth the Cubite. hh, A branch
 diſtributed from the 4. nerve to the outward ſkin of the Cubite. i, the vpper branch of the diuiſion of the 4. nerve. kk, A
 branch of i, reaching to the outſide of the hand. ll, the lower branch of the diuiſion of the 4. nerve paſſing through the back-
 ſide of the Cubite. m, the 5. nerve of the arme. n, Branches of this nerve diſperſed heere and there. oo, A branch of the 5.
 nerve reaching to the inſide of the hand and the fingers. p, A ſurcle of the branch o, deriued to the outſide of the hand and
 the fingers. qq, the 6. nerve of the arme and the courſe thereof vnder the ſkin. rr, the intercoſtall nerves there cut off where
 they are together with the ribs reflected forward. ſſ, branches on each ſide running backward. tt, Nerves attaining vnto
 the Cheſt. uu, the commixtion of the nerves rr, with the deſcending branch of the 6. coniugation of the braine. xx, Nerves
 from the loynes led vnto this place. y, A branch going to the teſticle here cut off. z, A nerve reaching to the 1. muſcle of the
 thigh. e, the 1. nerve of the leg. aβ, A ſurcle of the former nerve deriued to the ſkin at a and inſerted into the muſcles at β.
 γ, the 2. nerve of the leg. δδ, A nerve from the former, allowed vnto the ſkin as low as to the foot, and paſſing along the
 inſide of the leg. ε, a branch of the 2. nerve running vnto the muſcles. ζ, the third nerve of the leg. η, a ſurcle thereof vnto
 the ſkin. θ, another ſurcle vnto the muſcles. ιι, the 4. nerve of the leg. κκ, the anterior propagations of the nerves proce-
 ding from the holy-bone. λ, the end of the ſpinall marrow. μ, a branch from the 4. nerve inſerted into the muſcles ariſing
 from the *Coxendix* or hip bone. ν, another branch going to the ſkin of the thigh on the backſide. ξ, a propagation deriued
 to the 4. muſcle of the leg and to the ſkin of the knee. οο, nerves attaining to the heads of the muſcles of the foote. ππ, the
 diuiſion of the 4. crurall nerve into two trunks. σ, a branch from the trunk π, diſperſed into the outward ſkin of the leg. τ,
 a ſurcle of the trunk π, deriued to the muſcles. υ, another ſurcle to the ſkin of the leg on the foreſide. φφ, a branch of the
 trunk σ, to the ſkin of the inſide of the leg and of the foot. χ, a ſurcle of the trunk σ, to the hindmoſt ſkin of the leg. ψ, a
 branch of the whole trunk σ, led along to the forward part of the leg and the foot. ω, the deſcent of the trunk σ, into the
 foot.



which it is very necessary a Physition and Surgion should know, that he may be able to apply Oyntments, Cataplasmes and such like to the proper parts of the spine, when the nowle of the head, the face, the neck, the hands, the parts of the Chest, the muscles of the *Abdomen*, the wombe, the bladder, the fundament, the yard or the legges are depriued of sence or motion or both together.

CHAP. XXII.

Varolius his manner of dissecting the Head.

Here is in the body of man so great variety of all manner of parts, that it is impossible to follow the trace of nature by humane diligence so neerly that a man shal not sometimes wander out of his way or be at losse. It is therefore no wonder if the ancient and first Anatomists (men questionlesse very oculte and sharp sighted) did not yet attaine to the exquisite knowledge of all particulars, but left many things to be found out and perfected by their Successors. Nay we assure our selues that no proccesses of time, diligence of inquisition or helps of other mens labours shall euer be able to bring Anatomy to such perfection, but that there will be place left for them that come after to finde out something neuer before discovered; so like is this little world of mans body to the great globe of the Vniuerse, wherein every day new Countries and Nations, yea populous and rich states and Common-wealthes are by traouellers found out. An instance hereof in the Art we haue in hand is *Constantinus Varolius*, who in the yeere 1570. inuented a new manner of dissection of the braine, which how it is accomplished as we haue partly learned by his Epistles written *An. 1573.* partly by our owne dissection saith *Banhsine*, for these 24. yeeres together, we wil here relate, because it doth better exhibite the true originall of the spinall marrow and the nerues proceeding there from, as also the structure of the ventricles for our better satisfaction in the causes of the diseases of the head and the explaining of some passages in *Hippocrates* and *Galen*.

Varolius his
intention.

The difference betwixt these 2. Administrations is; that in the former, the vpper parts of the skull and the Meninges of the braine being remoued, the containd parts are layd open to the view. But in this which is full of labour and difficulty, the bones of the head are on euery side remoued; and the parts contained within the skull yet covered with both the membranes hauiug the eyes, the coniugations of the sinews and the spinall marrow ioyned thereto; are at one view represented and the Section begun at the basis of the braine. But for this Administration the head must be greene & not waterish, otherwise we shall loose our labour: you must therefore take the head of a man newly cutte off, or for want thereof a Calues head will serue the turne, because all the particulars may be therein discerned.

How admini-
stred.

Of the Spinall Marrow.

First of all we must begin at the *Spinall Marrow* which they say ariseth from the lower Basis of the braine at the great hole of the *Occipitium* or nowle bone. [tab. 25, Figure 1, from D to E] This is established within the skull in his proper seat and is compassed or inuested with the membranes: wherefore after the thicke Meninx is remoued, the other called *Pia mater* is also to be taken away, which is transparant and strong, and by whose mediation the forepart of the marrow is tyed to the braine and the hind part to the After-braine. It also detayneth or establisheth the *Spinall Marrow* that it be not reflected backward, which haply is the cause why Anatomists haue not knowne his true originall; for if you take it vp with a hooke and lightly remouue it with a knife from the parts vnder it, and bend the spinall marrow somewhat forward [tab. 25, fig. 2, ab] then will his originall shew it selfe to be not in the *Occipitium* or where it was first tyed to that thin membrane, but ascending somewhat vppward and in the forepart of the braine.

The admini-
stration of the
spinal marrow

This Marrow therefore consisteth of foure roots, whereof the two greater [tab. 25, fig. 2, bc, sheweth the trunk reflected, Charact. 4. and 1. shew the trunk in his owne seate] do issue out of two parts of the braine in the place wherein the ventricles are reflected [tab. 25, fig. 2, fg] from the forward prominence or swelling of the braine vnto the middle, and whereabout the Opticke nerue [tab. 25, fig. 2, cd] passeth without the ventricle.

The 4. roots
thereof.

The other two roots are two short trunks of the *Cerebellum* [tab. 25, fig. 2, Charac. 6.] arising

Where ioined
on

on either side out of the vpper part thereof, which are ioyned to the two greater productions of the Braine euen now spoken of, [tab. 25, fig. 2, betwixt the two Characters 2, and 3,] and so of 4, are made 2, [tab. 25, fig. 1, E] which afterward do accomplish the spinall Marrow, from which all the nerues of the whole body haue their originall as diligent inspection doth sufficiently prooue.

Galen acknow-
ledgeth the
truth of this.

And the same Galen affirmeth in the 13. chap. of his 8. Book *de vsu partium* and in many other places where he saith, That all the nerues which are attributed to the spinall marrow do arise from the After-braine, so that according to his Anatomy the spinall marrow is ioyned to the *Cerebellum*.

He is taxed by
Columbus.
Redeemed by
Varolius.

Some there are (and Columbus among the rest) who heerein taxe Galen, affirming that no nerue proceedeth from the *Cerebellum*. But, saith Varolius, Galens opinion may be after some sort maintained to be true; but those that find fault with him affirme that which is absolutely false, because the spinall marrow ariseth out of 2. roots of the brain whence 2. paires of sinews are produced, and out of 2. roots of the after-braine which are ioyned to the former and do together fulfill or accomplish the spinall marrow; and so all the nerues of the spinall marrow do arise out of the *Cerebellum*.

Why the ori-
ginalls of the
sinews grow
into one.

And verily that this should bee thus, it was profitable yea necessary; for the principles or originalls of all things had neede to be firme and stable. Now by how much any thing is more single and simple, by so much without doubt it is more solid and firme; wherefore it behooued that the originall of all the sinews should be but one simple and single originall. For if all the Arteries and Veines be reduced to one originall, the Arteries to the Heart, the Veines to the Liuer; it is agreeable to the wisdom of Nature that the Nerues also should proceede from one originall; because these are 3. common Organs or Instruments of the body through which the Animall, Vital and Naturall Faculties are by the helpe of spirits transported together with the Vitall and Naturall blood. And this both Hippocrates and Plato seeme to haue knowne. Hippocrates who in the beginning of his Booke *de Natura Osim* writeth, that the Originall of the Sinews is from the *Occipitium* which is the seate of the After-braine. And Plato in *Timaeo* speaking of all the Sinews writeth, That God disposed the Nerues about the lower part of the Head, and compassed them with a spinall Marrow, which is of a substance like vnto theirs.

Hippocrates
and Plato in-
nuate so much.

Why the spinall
marrow ariseth
out of the cen-
ter of the
braine.

Now the Originall of the Spinall Marrow was to be out of the middle part of the Braine, [table 25, figure 2, b c, and Character 4. do manifestly shew it] because through it as it were through a common water-course the spirits which are perfected in the midst of the Braine were to bee deriued into other Riuerets and so into the whole body. Wherefore their beginning was to bee placed in the center of the Braine, neere the Store-house or shop of the Spirits, whence they might receiue them as it were with a full streame; like as Anatomy teacheth vs, that the Arteries and the Veines do arise out of the middle of the Heart and the Liuer.

Obiection.

It will be objected, that this Trunke which heere we call the Spinall Marrow ought not to haue that denomination till it haue attained into the *Vertebra* or racke-bones of the Chinc, and therefore it is improperly sayd that the Opticke Nerues doe arise from the Spinall Marrow. Wee answere, that we haue before sufficiently satisfied this doubt in the 15. chapter of this Booke, yet for further contentment (if they will be contented with reason) we answere by instance; doe not the nerues of the Sight, Hearing and of the rest of the senses receiue their names from the Organes to which they are destinated before they touch those Organes? yea whilst they remaine within the scull? So also this Marrow may bee called the Marrow of the Backe, or the Spinall Marrow before it enter into the Spine. For whilst it remaineth within the Scull it is diuided from the Braine, and in it may be obserued proper Fibres belonging to it selfe alone.

Answered by
instance.

Of the After-braine or Cerebellum.

After we haue done with the spinall Marrow we must come vnto the *Cerebellum* [tab. 25, fig. 1, BB, fig. 2, Char. 8, 9, 10,] bared from the Membranes, which beside two processes called *Vermiformes* which are parts of the substance thereof, and beside the two lateral parts which resemble two bowles closed together, of which we spake sufficiently before in the 14. chapter of this Booke: there remaineth yet another processe thereof to be exhibited and manifested vnto you.

This

Table 25. Figure 1. sheweth the Braine taken out of the Scull separated from the Dura Meninx and inuverted^s whose right side exhibiteth the Originall of the Spinall marrow and the seven Coniugations of the Sinews of the Braine, according to the ordinary received opinion: but the left side sheweth their true originals.

Figure 2. sheweth the Braine inuverted, and the parts thereof in the Basis distracted, as also the Originall of the Spinall Marrow out of the Braine and the After-braine, the largeness of the ventricle, and the Originall of the Opticke Nerue out of the Marrow.

TABVLA. XXV.

- AAA**, The Braine.
BBB, The After-braine.
CC, The swellings of the braine commonly cald the *mamillary* pro-
cesses.
D, The beginning of the marrow of the back, as it is commonly be-
lieued.
E, The termination or end thereof in the Scull.
F, The originall of the Organes of smelling according to the vulgar
opinion.
H, The originall of the opticke Nerues, as it is commonly received.
I, The coate into which the Opticke Nerue is inserted.
2, The second paire of sinews.
3, 4, 5, 6, 7, The coniugations of the sinews, whose originall *Vesalius*
himselfe attributteth to the beginning of the Spinall Marrow.
8, A branch of the third coniugation as Anatomists doe beleue:
which passeth forward, but we take it to be the 3. coniugation.
9, A brāch of the 5. coniugation according to *Vesalius*, but we esteem
it to be a coniugation of it selfe, and therefore cal it the 8. paire.
10, 11, 12, 13, The barke or shell of the Braine; for 8, 9, 10, 11, is the
very marrow of the Braine it selfe, and these two are not continu-
all but onely contiguous, or touching one another.
ab, The whole Optick nerue, and at *b*, is the reflection of the nerue to
the backpart of the Spinall Marrow.
c, The coition or concourse of the Optick Nerues.
de, A part of the 2. nerue not comonly known, whose original is at *e*.
f, g, h, The Marrow of the Braine lengthened and determining in the
Spinall Marrow.
k, The transuerse proceffe of the After-braine which is called the
Bridge.
ll, The auditory Nerue arising out of this proceffe.
lm, The passage of the Organ of smelling lurking betweene the vp-
per and middle prominence of the Braine, & at *l*, is his originall.
n, The middle prominence of the Braine diuided from the rest of the
Braine.
o, The beginning of the backward prominence of the braine from
whence the middle was dissected.
p, The intercussation which the Optick Nerue maketh with the nerue
that moueth the eye.

The Second Figure.

- 1, 2, 3**, The halfe of the Spinall marrow drawne to one side,
4, 5, The coniunction of the same marrow with the ventricle. **6**, A portion of the Spinall marrow growing out of the Af-
ter-braine. **7**, The Optick Nerue reflected in the backpart of the spiaall marrow and entering into the cavity of the ven-
tricle. **8, 9, 10**, The left side of the After-braine from which the right side is remooued. **11, 12**, A slit going vnto the 2. ven-
tricle, which slit is formed partly by the body of the Arch, partly from the inner part of the spinall marrow. **13, 14**, The
coniunction of the right and the left sides of the braine by the Callous body. **a**, The right part of the Spinall marrow refle-
cted vpward to his owne side, that so the originall thereof which is in the cavity of the ventricle might be perceiued. **bc**,
The beginning of this marrow as it respecteth the hollownesse of the ventricle. **de**, The Optick Nerue reflected about the
roote of the Spinall Marrow. **e**, the first originall of th Optick Nerue. **f, g, h**, the whole cavity of the ventricle, **f** sheweth the
Anterior, **g**, the middle, and **h**, the Posterior cavity hollowed in the Braine. **ik**, the complication of vessels cald *Plexus cha-
roides* about the roote of the spinall marrow in the ventricle. **lm**, A portion of the Basis of the Braine which together with
the spinall marrow maketh the cleft which entreth into the ventricle. **no**, the length of the callous body which ioyned to-
gether the two sides of the braine. **pqr**, Portions of the braine reflected backward that the cavity of the ventricle might
better be perceiued.

This proceffe is a very notable one, [tab. 25, fig. 1, k] arising on either side out of the Cere-
bellum neere the trunks whereof the spinal marrow is amassed, & runneth ouerthwart forward
and downeward, by the mediation whereof this After-braine imbraceth the fore-part of the
Spinall Marrow after the same manner that the transuersall or ouerthwart muscles of the

The proceffe
called the
Bridge.

Larynx,

FIG. I.

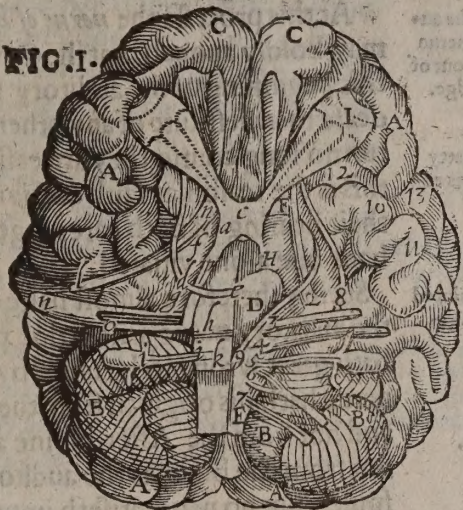
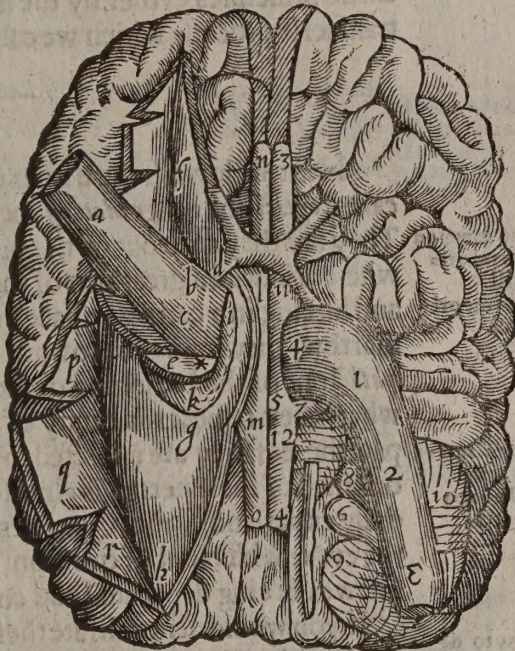


FIG. II.



Larynx, making the 3. paire of common muscles doth imbrace the backpart of the beginning of the *oesophagus* or gullet and thence are called *oesophagi*: and this proceſſe is diſtinguiſhed by a courſe of ouerthwart fibres with a kinde of eminency from the right fibres of the Spinal Marrow.

This proceſſe *Varolius* calleth *pontem cerebelli*, the bridge of the After-braine, from the ſimilitude it hath with a bridge, becauſe vnder it the ſpinal marrow runneth as a ſtreame runneth vnder a bridge.

How the auditory nerue ariſeth out of the Bridge.

Two pretty queſtions reſolued.

Galen injured by the *Necroticks*.

Varolius.

At this proceſſe the *nerue of hearing* hangeth and hence ariſeth, [*tab. 25, fig. 1, i*] ſo that we may boldly aſſure that the *Cerebellum* is alſo the firſt originall of the ſenſe of hearing. And this beginning of the auditory nerue teacheth vs the cauſe why more from the infancy are deafe then deſtitute of any other ſenſe; for becauſe they proceed from the After-braine and run no long courſe, they are eaſily filled and choaked with *Mucous* and ſlimy excrements; and this is the reaſon, as ſaith *Cassius* in his 17. Probleme, why children from their infancy looſe their hearing of both eares together, whereas vpon an accidentall diſeaſe it is more vſuall to haue one alone vitiated.

Seeing therefore almoſt halfe of the ſpinal marrow and this proceſſe or bridge from which the auditory nerue ariſeth doe proceede from the After-braine; *Varolius* thinketh that *Galen* hath great wrong to be taxed by the late Writers, when as they affirme againſt him that no nerue hath his originall from the *Cerebellum*: for ſaith he, ſome nerues ariſe only from the brain and not from the After-braine as the optick ſinews; ſome from the After-braine only, and not from the brain as the auditory nerues; ſome from them both together as the nerues of the ſpine: but no nerue ariſeth immediately out of any of the two principles but all out of their owne principles eyther by the mediation of the ſpinal marrow or by the mediation of that tranſuerſe proceſſe which we called the Bridge.

Of the Nerues of the eyes.

The common received originall. The true originall.

Why Cauterics at the necke helpe the eyes.

How to demonſtrate the Opticke nerues.

The moving nerues.

Why both eyes moue together.

Next followeth the nerues of the eyes, and becauſe there are two payre of them, the one called *optici*, the other *motorij*, becauſe they moue the eyes; we will firſt ſpeake of the *opticks*. They ſay they ariſe out of the baſis of the braine but toward the forepart, [*tab. 25, figure 1, i*] whereas indeed a great part of them proceedeth from farther off, [*tab. 25, fig. 1, from p to b*] and lurking in a certaine ſpace formed betwene the braine and the beginning of the ſpinal marrow, they runne out toward the *occiput* where they ariſe [*tab. 25, fig. 2, ſheweth their originall*] out of the beginning of the former trunks of the ſpinal marrow, [*tab. 25, figure 2, b c*] where they reſpect the cavity of the ventricles of the braine, [*tab. 25, fig. 2, g*] and in the backpart thereof they are reflected toward the middeſt. [*tab. 25, fig. 2, d e*] Wherefore ſeeing the originall of theſe nerues is almoſt in the *occipitum*, it followeth (as alſo we finde it true by daily experience) that Cauterics applied to the *Occipitum* are of great vſe in the diſeaſes of the eyes: which out of queſtion hapneth becauſe the originall or beginning of the opticke ſinewes being depurated and confirmed, the viſible ſpirits haue freer recourſe vnto the eyes.

If you would demonſtrate theſe ſinews you muſt remoue the *Pia mater* at that place where the Opticks are commonly ſaide to ariſe; but carefully that you hurt not the nerue, and then you may perceiue that the braine there is onely contiguous; then draw the braine lightly forward from the marrow till you finde the Opticks there lurking, and if you thruſt a probe without violence between them and the parts to which they adheare, you may lift them from the ſubieſted parts till you come to their originall, and withall you ſhall perceiue where the ſpinal marrow taketh his beginning out of the braine. They ſay commonly that the moving nerues [*tab. 25, figure 1, Chara. 2*] haue their beginning nere the Opticks, a little more outward; but if you cut a part of the braine toward the midſt you ſhall perceiue them diſtinguiſhed from the braine to attaine to the middle of the head and to paſſe vnder the Opticks after they haue made an intercuiſſion, [*tab. 25, fig. 1, d*] that is, haue croſſed one the other, and do ariſe at the inner part of the beginning of the ſpinal marrow, [*tab. 25, fig. 1, e*] and in their originall are ſo vnited that they touch one another in one corner, which haply is the cauſe why both the eyes are together moued to the ſame ſide.

That the reſt of the coniugations of the ſinewes of the brain do yſſue from the Spinal marrow, *Vesalius* is content to affirme, excepting onely the third. *Columbus* acknowledgeth that third with all the ſubſequent coniugations to ariſe from the ſaid marrow, and for the two firſt paires we haue euen now proued their originall: it remaineth that we proceed to the inſtruments of ſmelling.

The

The Instruments of Smelling or the Mammillary processes.

The instruments of smelling or the *anterior* processes of the braine which proceed outward betwixt the optick nerues vnto the fissure of the spongy-bone scituated at the top of the nose, are commonly esteemed to arise out of the basis of the braine [tab. 25. fig. 1, F] neere the conjunction of the optick nerues [tab. 25. fig. 1, C] But the truth is, that Anatomists hitherto haue shewed only the one halfe of these instruments; for beside that they doe shew [tab. 25. fig. 1, from m, forward] they proceede as much farther [tab. 25. fig. 1, from m, to l,] lurking betwixt the forward and the middle swelling of the braine; for their progresse is backward, and by how much they reach further, by so much is the distance more betwixt them. They are also by little and little attenuated, growing thin vntil they determine into a sharp point at the sides of the braine almost at the utmost limit thereof [tab. 25. fig. 1, at n] which is about the holes where the aire beateth into the eare, for this is the place of their original. And hence haply it is that if the smelling be intercepted, the hearing also is somewhat affected; for we see that when vpon a cold or murre (as we call it) the nose is stopped and the smell hindered, the hearing also is somewhat offended: we also manifestly perceiue that when we sneeze or blow our nose or retaine our breath by shutting vp our nostrils, the hearing is also instantly interrupted, and those that loose their smell doe very easily become deafe: it may also be that from this sympathy that Probleme of Aristotle the 5. of the 11. Section, and the 23. of Cassius, Why those that be deafe do speake through the nose may be alloyed.

Their common receiued originall.

Their true originall.

Of the sympathy between hearing and smelling.

Of the Ventricles of the Braine.

These things being thus demonstrated, and the eyes with the optick nerues being drawn each into their own side, you must lengthwise cut into 2. parts the bridge of the *Cerebellum* and the spinall marrow, then must you remoue the *Cerebellum* quite away, and one part of the spinall marrow so denided lengthwise as we said before must be drawne to his own side, and one side of the braine both before and behind must be cut to shew the magnitude and figure of the ventricles thereof, for this Administration sheweth a great difference in the scite, magnitude, forme, number and vse of them from the common demonstration.

How we must proceed in this kind of section.

The receiued opinion is that there are 4. ventricles, *Arantius* in his obseruations accounteth six, 4. acknowledged by the ancients and vnder these 2. other; but indeed and truth by how much the number is increased, by so much is the error the greater, there being in truth but 2. for the braine both of man and beasts being double, as 1. *Hippocrates* obserued in his Book of the *Falling sicknes*, and after him *Aristotle* in the 10. chap. of his 4. Book de *Historia animalium*, it seemeth equall that each part should haue a ventricle. For those 2. which they place in the forepart of the braine are as well seated in the middle and in the hind-part as they are before: for hitherto scarce their 4. part hath beene demonstrated, their magnitude being answerable and proportionable in respect of their forme to the magnitude of the whole braine, and the swelling prominences thereof: neither is it to be doubted but that the cauities of the braine while the creature is alieue are farre larger then after he is dead, because after death the braine that was stretched and as it were extended with spirits, when those spirits are vanished falleth into it selfe and so the cauities are lessened and contracted.

Hippocrates Aristotle.

The magnitude of the ventricles.

Now the brain is on either side long, and where the 2. sides the right and the left do regard each other it is plaine and depressed, in other parts it hath sphericall or round productions or prominencies answerable to the hollownes of the bones wherein it is contained.

The *anterior* or forward prominence filleth the cavity formed by the forehead bone, a part of the spongy bone, the bone of the *sinus* or side of the head, and the wedge-bone, the middle and lower prominence filleth on both sides the cavity formed by the backpart of the wedge-bone, the forepart of the stony-bone and the bone of the temples.

The anterior prominence.

The *posterior* or backward prominency filleth the cavity made by the vpper part of the *occipitum* and the latter part of the wedge and stony-bones. And to these prominences the cavity of the ventricles is answerable; for from the forward prominences there runneth a notableosome or hollownes, euen vnto the latter or backward; which *Sinus* or hollownesse is so farre distant from the out side of the braine in the backpart as it is in the forepart.

The posterior.

But when it attaineth vnto the angle or corner which is in the vpper part of the stony-bone, it is reflected to the middle and lower prominence of the braine, and after the same manner

is excavated or hollowed in that prominence or production as it is in the *Anterior* or *Posterior* parts.

But why is the ventricle thus figured? why did Nature neglect the round figure and reflect it thus into it selfe? *Mercurialis* maketh answer; That as in a pond or Lake wherein water may rage, men do frame out some oblique angles, or corners wherein his direct & impetuous course might be broken: or as it was in that Haven into which *Æneas* put in a storme, against the sides whereof *Virgil* saith:

omnis ab alto

Frangitur, in-que sinus scindit sese unda reductos.

The waues are broken from the Mayne,

And in the Creekes are cut in twaine:

So Nature to interrupt the violent motion of the spirits, least they should offend the wals as it were the shores of the ventricle, cut out these angles or set out these Peeres against which or in which their violence might be broken.

Furthermore the braine, which without the compasse of the ventricles is very thicke (considering the ventricles as they are commonly demonstrated;) if you haue a respect to these two ventricles as we exhibite them, is farre thinner then it is in others parts, & like a shell compasseth these 2. cavities, which truly might be called but one ventricle were it not distinguished by the interposition of that body which is called *Corpus callosum*; [tab. 25. fig. 2. mmo] and these only are the ventricles of the braine. Now what those parts are which are commonly called the 3. and the 4. ventricles it remaineth that we shew vnto you.

What are the
3. and 4. ven-
tricles com-
monly so cal-
led.

The whole braine as also the spinall marrow is diuided into two parts, and is only ioined in the middle and lower part by that Callous body we spake of euen now, [tab. 25. fig. 2. mmo] which is nothing else but the braine in that part conioyned. For where the right and the left parts were to be ioined they are bent a little outward, afterward growing white they are reflected to the middest and so vnited. This vnion hath a kinde of conuexity or embowed figure proportioned to the conuexity of the brain, which also is as long as the sagital suture or seame. Some think that it is harder then the other parts, but we thinke it is as soft as the braine it selfe, and is very white like the inward parts or sides of the ventricles. The interior part of this vnion is ordinarily called *Fornix* or the Arch.

The *Corpus*
Callosum.

The Arch of
the Braine.

The 2. Trunkes produced from the braine being become round do touch one another, and so bend somewhat forward; but againe returne backward toward the hole of the *Occipitium*; and because they are round bodies they make betwixt themselves in their first contaction a light angular or cornered cauity vpon which the Basis of the braine being vnited doth leane it selfe, so that from the mutuall touch of the bodies before spoken of, that space is formed which they call the 3. ventricle, which to say truth is without the braine and formed not by any intention of Nature but of necessity, because of the coniunction of these bodies.

The third
ventricle.

In the vpper part hereof towards the sides there appeare 2. long slits or fissures which run almost through the middle circumference of the trunkes of the spinall marrow, and so passe into the ventricles of the braine, and by the way of these fissures the ventricles haue an outlet vnto that they call the 3. ventricle. And because the foresaid trunkes do reach as farre as to the Saddle of the Wedge-bone where the Tunnell is, therefore it is commonly said that the *Anterior* passage of the 3. ventricle reacheth vnto that part.

The fourth
ventricle.

The 4. ventricle so called, is a *Sinus* or hollownes betwixt the lower part of the *Cerebellum* & the vpper trunkes of the spinall marrow, where the same spinall marrow is caued or hollowed like a writing pen. This *Sinus* or bosome is made of the 2. trunkes proceeding out of the *Cerebellum* for the framing of the spinall marrow, & is lengthened out of the distance of both those propagations of the After-braine. For before they bee vnited with those two other greater trunkes which arise from the braine it selfe, they passe along about them a litle distant one from the other. So that this cauity like as the other, ariseth rather vpon necessity of the position of the parts then from any foresight or intention of Nature; because like as the third so also this fourth ventricle is situated without the braine and the *Cerebellum*.

The funda-
ment of the
Braine.

That hole which is called the latter *foramen* of the 3. ventricle, which some make to be like vnto the fundament and will haue to enter into the 4. ventricle; is nothing else but a space made by the contaction or mutuall touching of the 4. trunkes of the spinall marrow where the trunkes of the *Cerebellum* are bent downeward and adheare or cleaue to the Trunkes arising from the braine.

The buttocks
and Testicles.

Here appeare foure orbicular prominences commonly called the Buttocks and the Testicles of

of the braine, which they commonly affirme to be within the braine though indeed they are without. And these *Varolius* thinketh to be the true originals of the spinall marrow: and that the buttocks are nothing else but portions of the roots of the spinall marrow proceeding out of the *Cerebellum*, like as the Testicles are small portions of the roots proceeding from the Braine.

The buttocks
and Testicles.
The true ori-
ginals of the
spinall marrow
after *Varolius*.

Concerning the vse of the ventricles, the common opinion is, that they are the receptacles or receptacles of the Animall spirits as the left ventricle of the heart is the place of the vitall spirit. But although we wil not deny that there may be many vses assigned to one and the same part: (and therefore *Galen* in the 10. Chapter of his 8. Booke *de Usu partium*, was of opinion that the vpper ventricles did serue for the preparation of the spirits and also for the expurgation of superfluities,) yet we are of opinion that these ventricles are the receptacles of the phlegmatick humor which is ingendered in the braine, which through the *infundibulum* or Tunnell is conuayed to the phlegmatick glandule and so purged away. For the ventricles haue no where any outlet but only at the Tunnell: but for the Animall spirits we thinke that they are disseminated through the whole substance both of the Braine and of the After-brain. And this we shew first by the testimony of *Hippocrates*, who when he had deliuered that man consisted of 4. humors, and did assigne to euery one their proper place he saith; That the place of the spirits and of the blood is in the heart, of yellow choler in the Liuer, of blacke in the spleene. And if the place of phlegme be in the braine there must of necessity be a cavity which may containe it; such as is the ventricle in the heart and the bladder of gall in the Liuer. Now beside these two ventricles there is in the braine no cavity at all.

The vse of the
Ventricles.

Galen.

That the ven-
tricles receiue
the phlegme.

Hippocrates
his 1. reason.

Secondly, it is proued by the generall vse of Glandules which is to sucke vp and consume superfluous humidity. Whereas therefore in these ventricles there are Glandules found in that complication or web of vessels therein disposed; it followeth that phlegme is therein gathered, which distilleth out of that texture or web into the ventricles and there is heaped together; (for they are not able to consume so great a quantity) otherwise both the glandules should be in vaine added by nature, and their vse and commodity assigned by *Hippocrates* should be idle and of no vse.

2. Reason.

Furthermore it is acknowledged by all men that the phlegme doth distill from the braine through the Tunnell vnto the Pallat. Now the beginning of the Tunnell is in the ventricle, neyther is there any passage from any part of the braine vnto the Tunnell vntlesse it be out of the said ventricles.

3. Reason.

Fourthly, it is proued by an argument taken from necessity: because this phlegmaticke excrement did require great and large cavities. For if there had beene no conuenient place wherein a notable quantity thereof might bee stabled or heaped together; wee should haue beene troubled with continuall spitting and spawling (euen as they in whose bladders the vrine is not collected and retained doe continually awoyd their water by drifling or drops) and so our speech and other noble actions interrupted. And hence it is that in sleep a great quantity of this phlegme being collected, after we awake we auoide it plentifully in a short time. Now this quantity because it could not be contained within the *Dennes* or hollow cavities of the nose behooued to haue some other receptacle in the braine wherein it might bee reserved till convenient time of euacuation.

4. Reason.

Many instan-
ces from our
sence.

We do also sensibly perceiue that if a man be desirous to spit and therefore suck the vpper part of his Pallate; he shall gather great quantity of this phlegmaticke excrement into the cavity of his mouth and thence spit it forth. But if he againe instantly strue to spit he shal auoid a lesse quantity; and so lesse and lesse till by sucking he can gather no more spittle. But after a short interim or interposition of time the excrement will againe fall into his mouth; which is a most euident signe that this matter is in some notable quantity collected or gathered together before it be auoyded as it is in the vrine and the excrements of the belly.

What we con-
clude.

Wee conclude therefore that these cavities of the ventricles do receiue the foresaid excrements, because those glandulous complications doe enter into them; and out of them only are the passages by which the moysture is auoided.

Mercurialis opposeth on this manner. How may it be that so thicke, cold and obscure or dull a humour so contrary to the Spirits should bee collected in that place where the Spirits themselves which are pure and subtile bodies are as it were in an Ouen baked and perfected? Moreover, the causes of an Apoplexie, Epilepsie or Falling sicknesse, and the *Incubus* or Night-Mare, are by all Physicians acknowledged to bee, when as Flegme or Melancholie, or Crasse and thicke winde is retained in the Ventricles, which stopping them vp cyther wholly

Mercurialis
his obiections.

Hippocrates

wholy or for the most part, do strangle the spirits therein contained, which (as *Galen* saith in his 3. Book *de Locis affectis*) *Hippocrates* signified in darke and obscure words in the end of the second Section of the first Booke *Epidemion*, where he writeth, *That the disease called Melancholia hapneth when the humour falleth into the seate of the minde, and the Epilepsy when it falleth into the body of the braine.*

Plato.

Plato also consenteth with *Hippocrates* in *Timaeo* where he writeth, that the falling sicknesse happeneth when Flegme mingled with Melancholy catreth into the diuine caviities of the braine. *Varolius* maketh answer on this manner. For the causes of the Apoplexy, Epilepsy, and *Incubus*, although I sometimes read in *Hippocrates* as in the 9. Text of his Booke *de Glandulis*, that the Apoplexy is occasioned by the *Corrosion* of the braine, and in the 19. and 20. Text of his Booke *de Flatibus*, that the Epilepsy is caused when the blood is disquieted and defiled in all the veines, as also when the same veines are obstructed. And that I read in *Galen* in the 7. Chapter of his 3. Book *de Locis affectis*, that he doubted whether the Epilepsy were made by an obstruction of the ventricles of the Braine, of the Spinal Marrow, and therefore that I willingly graunt that these diseases may haue these causes: yet I conceiue that it will not abhorre from reason to thinke that the ventricles (though the Animall spirits be contained in them) are sometimes so fulfilled with a viscid humor or thicke wind, that the first root of the Spinal marrow may be compressed by the aboundance thereof, so that the transportation & affluence of the spirits thereunto may be interrupted and intercepted, and consequently the whole body deprived of Sense and Motion. Like as the Bladder in the suppression of the Vrine being beyond measure distended lying hard vpon the guts, the auoyding of the excrements is hindered.

Varolius his
Answer to
Mercurialis.The causes of
the Apoplexie.
Hippocrates.
Galen.Do not con-
tradict *Varo-
lius* opinion.Another satis-
faction.This opinion.
Confirmed
by Dissection.

And if this answer will not please the Pallate, I will say with *Galen* in the place before quoted, that the Epilepsy and such like diseases do proceede by the obstructing or immuring of the Spirits, which happeneth when the beginning of the Spinal Marrow is choaked by an vnnaturall confluence of humours vnto it. And this opinion is confirmed by the Dissection of the Heads of such men as dye Apoplecticall, in the Ventricles of whose brains there is not found any greater quantity of excrements then is commonly found in other men.

Another
Obiection.
Answered.

Furthermore, they Obiect that in the Epilepsie, the Apoplexy and the *Incubus*, the Animal spirits residing in the Ventricles of the Braine are strangled or their out-gate hindered. *Varolius* answeres that these diseases happen not from any humour or winde atteyning any way vnto the Ventricles, but by reason of a great quantity and notable thicknesse, or sudden eruption. Wherefore euen as the excrements descending by the Pallate and the Nose do not offend the taste or the smell if they passe through those Organs moderately and according to Nature, but do either hinder or vterly intercept their Operations if they exceede the Measure and Proportion of Nature in quantity or in quality: so wee thinke wee are to conceiue of the excrements accruing vnto the Ventricles of the braine or receding therefrom.

That the spi-
rits are in the
substance of
the braine.
Galen.

Now that the Spirits are dispersed through the substance of the braine, wee prooue by the testimonie of *Galen* in the 13. Chapter of his eighth Booke *De Vsupartium* where hee sayth, That the Animall spirit is in great quantity conteyned in the body of the braine, as also of the *Cerebellum* to which hee attributeth the Originall or beginning of the Nerves of the whole body, and therefore he inferreth that it is necessary it should be filled with the aboundance of spirits.

The conclu-
sion.

If therefore the *Cerebellum* which hath in it no cavity at all doth yet conteyne in his substance plenty of spirits which flow from it to so many nerves removed by so great distances therfrom, why may we not beleuee that after the same manner yea a great dealc rather the spirits may be conuayed without manifest caviities out of the braine to a fewer nerves and those not far distant from it but euen at hand? Seeing therefore that the Animall spirits can ebbe and flow without any sensible passage, why may wee not ascribe that vnto the substance of the braine which others haue ascribed vnto the Ventricles because they haue not duely obserued them?

Of the web or complication called Plexus Choroides.

Of the Plexus
Choroides.

Finally, the complication or web of vessels which they call *Choroides* or the Net which is in the Ventricles of the braine [tab. 25, fig. 2, ik] seemeth to be altogether glandulous or kernelly

nelly, so that both in substance and colour it may be likened to the Pine-glandule we spake of in the 12. Chapter; yet if you handle it nicely and mark it diligently, you shall find that it is nothing else but a heape of broade and long membranes growing out of the *Pia mater* of the braine, at the one side whereof through out their whole length hangeth a little thicke vessell full of excrementitious moysture, through which exceeding small vessels are deriued: and if wee compare little things with great, it is like a gut tyed vnto the mesentery, yet for the proportion of it, there are more glandules then in the mesentery of the lower belly. And this manifestlie appeareth in their heads whose braines are very moyst and therefore saith *Varolius*, it were more agreeable to their nature to cal them glandulous then *Net-like complications*.

What it is.

And if any man doubt whether the substance of them be such as we haue said, we remit him vnto his owne ocular inspection, there being no argument of greater validity. For saith *Varolius* in all carkasses which we haue opened, we haue found these glandules ful of such a muddy moysture as we finde in the rest of the glandules of the body. Albeit *Archangelus* doe thinke that such excrements are onely found in diseased braines.

That it is glandulous.

The vse of this glandulous complication seemeth to be; that like other glandules it might sucke vp the superfluous moysture of the braine, for that is the office of the glandules in the whole body: yea *Hippocrates* himselve in the second Text of his Book *de glandulis*, proueth by an induction of the particular glandules of the whole body, that when the body aboundeth with superfluous humidity it is thereof exonerated and discharged by the glandules; yea hee proceedeth so far as to say that the whole substance of the braine is glandulous.

The vse of this complication.

Now concerning the rest of the parts of the braine of which in this new demonstration or dissection we haue made no mention, you must conceiue of them as their histories are described before.

But if a man be desirous in this kinde of Section to demonstrate or exhibite to the spectators all the parts, then must he proceede in this order. After he had taken away all the bones of the head by sawing them through the length aboue and beneath, before and behind, he must first make demonstration of the *Sinus* or vessels of the *dura meninx*. Afterward turne the head and at the Basis of the braine separate the *Meninx* from the spinall marrow, yet must he leaue portions of the *Meninx* about the nerves that they be not broken, for then you cannot follow them to their originall.

How this must be accomplished.

Vnder the membrane which inuesteth the spinall marrow there appeareth a texture or web of vessels diuersly crossing one another, which they commonly call *Rete mirabile*, the Wonderfull Net; then the flegmatick glandule commeth in sight which is almost square, and the neck of the Tunnel which are scituated without the thick *meninx*. From hence our eye passeth vnto the membrane of the spinall marrow and the marrow it selfe; which being lifted vp we behold the buttockes, the testicles, the passage into the fourth ventricle and the fourth

How the particular parts of the brain arise.

ventricle it selfe, all which are without the braine. Wee see also the After-braine, the processes thereof, the Auditory Nerue, the mouing Nerves of the Eye together with the Opticks, the Organs of smelling, the two ventricles of the braine together with their passage into the Tunnell, as also the Callous body, the Arch, the Complication called *Choro-*

roides, and the Pine-glandule. And thus much

concerning *Varolius* his new way of disse-

cting the head, which we haue added

as an accomplishment to this

Book of the braine, because in-

deed after this manner all

the parts thereof are

best shoune and

to best purpose.

Now we pro-

ceed to the

Contro-

uersies.



A Dilucidation or Exposition of the Controuersies concerning the Braine and the Parts thereof.

QUEST. I.

Whether the Braine be the Seate of the Principall Faculties.

A division of
the Animall
Faculties.
The common
sense.



THe Animall Faculties are by the Physitians distinguished into Faculties of *Sense*, Faculties of *Motion*, and *Principall* Faculties. The sensitive Faculty is double, one Externall whose object is Singular or one; the other Internall whose object is common or manifold: this Internall Faculty, the Philosophers call the *Primarie* or *Common sense*; and this is it which alone maketh the differences of *Images* as we call them or *Abstracted Notions*. She sitteth in the substance of the Braine as in a throne of Maiesty beholding the *Formes* or *Ideas* of all things vnder her feet. This is she that discerneth betwixt sweete and bitter, and distinguisheth white for sweete. This common sense *Aristotle* compareth to the center of a circle, because the shapes and formes received by the outward senses are referred or brought hereunto as vnto their Iudge and Censor.

The Imagina-
tion.

After this inward sensitive Faculty do follow the principall Faculties, and first of all the *Imagination* which conceiueth, apprehendeth and retaineth the same *Images* or representations which the *Common sense* receiued; but now more pure and free from all contagion of the matter, so that though those things that moue the senses be taken away or otherwise doe vanish, yet their footsteps and expresse Characters might remaine with vs. And this conception or apprehension we call *Phansie*. By this *Phansie* that supreme and soueraigne *Intellectuall* power of the Soule is stirred vp and awaked to the contemplation of the *Ideas* or *Notions* of vniuersall things.

The Intelli-
gence.

The memory.

Finally, all these are receiued by the *Memory*, which as a faithfull recorder or Master of the Rolles doth preserve, store vp and dispose in due order all the forenamed *Notions* or abstracted formes. And these are the principal faculties according to the Philosophers and the Physitians, concerning which we haue three things to enquire.

3 Questions.

The first, whether the Braine be the seate of them all. Secondly, whether in the Braine these diuers faculties haue diuers Mansions. And lastly, whether these principall faculties do result or arise out of the temperament or from the conformation of the Braine, that is, whether they be *Similar* or *Organicall* actions.

Diuers opini-
ons.
Herophilus.
Xenocrates.
Erasistratus.
Empedocles.
Moschion.
Blemor.

Concerning the seate of the Reasonable Soule, the opinions of the Philosophers and Physitians are verie different. *Herophilus* placeth it about the Basis of the Brayne. *Xenocrates* in the top of the Head. *Erasistratus* in the Membranes of the Braine. *Empedocles*, the *Epicures* and the *Egyptians* in the Chest. *Moschion* in the whole Body. *Heraclitus* in the outward motion. *Herodotus* in the Eares. *Blemor* the Arabian in the Eyes, because the Eyes are the discoverers of the Minde, and so fitted and composed to all the affections and affects of the same, that they seeme to be another Soule, for when we kisse the Eye we thinke we touch the soule it selfe.

Strato Phys-
icus.

Prouerbe.

Strato the Naturalist thought the Soule inhabited in the Eye-browes, because they are the seate of *Pride* and *Disdaine*, and therefore the Poets were wont to call *Pride* the Eye-brow, and we commonly say of an insolent man, that we see pride sitting vpon his browe. Moreouer from the haire of the browes the Physiognomers gather signes of the disposition of the Minde

minde. For if they bee straight it is a signe of a soft and flexible disposition; if they bee inflected neere the nose they are a signe of a scurrulous Buffon; if they bee inflected neere the temples they argue a scoffing Parasite; if they bend all downewards they are an argument of an envious inclination. The *Peripateticks* and *Stoicks* doe all of them place the faculties of sense and vnderstanding in the heart, because say they that that is the principle or beginning of motion, is also the originall of sense: But the heart is the principle of all motion, because it is the hottest of all the bowels and a liuing fountaine of Naturall heate. Moreover, in passions of the minde, as Agonies, Feares, Faintings and such like, the Spirits and the Heate returne vnto the Heart as vnto their Prince. And for this they bring the authority of diuine *Hippocrates* in his golden Booke of the Heart, where hee saith, *The Soule of a man is seated in the left ventricle of the heart, and from thence commandeth the rest of the faculties of the Soule, and it is nourished neither with meate nor drinke from the belly, but with a bright and pure substance segregated from the blood.*

Strato his Thy
slogomy of
the eye-brows.

The opinion
of the *Peripa-
teticks*.

Hip. authority.

We with *Hippocrates*, *Plato*, *Galen* and Physicians, do determine. That the braine is the seate of all Animall faculties, for if the braine be offended, wounded, refrigerated, inflamed, compressed, or after any other manner affected, as it is in a Phrensie, *Melancholia*, *Caros*, *Catoche*, or *Epilepsie*, we may discern a manifest impeachment of all the Animall functions, which if we desire to cure, wee apply our remedies not to the heart but to the braine. But if the heart were the seat of the principall faculties then in all affections or notable distemper thereof, all the functions should bee interrupted, because the action is from the Temperament. But in a *Hecticke* Feuer in which there is an vtter alienation of the Temperament, the voluntary and principall faculties remaine sound and vntainted. When the heart is violently moued as in Palpitation, neither is the voluntary motion of the parts depraued nor reason it selfe. Who will deny that the vitall faculty is oppugned by a pestilent aire, the byting of a venomous creature, or by taking of poyson: but all those that are so affected do yet enioy their sense and reason. If (saith *Galen* in his 2. Booke *de placitis Hippocratis & Plat.*) you bare the heart and presse it, you shall perceiue that the creature will not be hindred in his voice, his breathing or any other voluntary action.

The opinion
of the Physi-
cians.

That the brain
is the seat of
the Animall
faculties.

And whereas *Hippocrates* placeth the Soule in the heart, haply he speaketh after the manner of the common people as he vseth oftentimes to doe; now the vulgar imagined that the soule was in the heart. So he calleth the *Diaphragma* or Midriffe *opis* the Minde, when as notwithstanding those Vmbles haue no power whereby the creature doth vnderstand any thing, as he teacheth in his Booke *de morbo Sacro* or the Falling sicknes.

Hippocrates
Expounded.

Or we say that by the soule in that place he vnderstandeth the chiefe instrument of the soule, to wit, the Heate. So in his 1. Booke *de Dieta* he commonly vseth the word Soule for Heat, as when hee saith *That the Soule of man is encreased euen vnto his death.* And againe in the same Booke *The Soule creepeth into a man being mingled of fire and water.* Where by the Soule I vnderstand the heat throughly dewed or moystned with the in-bred and primigeny moysture and the spirits. And that in his Booke *de Corde* by the Soule he vnderstandeth the heart, those words doe declare, where he saith, that the Soule is nourished by the most pure and defecated blood. Now in his first Booke *de Dieta*, he writeth that the Soule cannot be altered neither by meates nor drinks. Which place because it is as bright as the Sun in his strength and worthy to bee written in golden Letters, we wil here transcribe. *The causes of all those things whereby the Soule is altered, are to be referred to the Nature of the passages through which it penetrateth. For as the vessels are affected whereinto it retyleth and to which it falleth and with which it is mixed, such is their condition; and therefore we cannot alter them by dyet, for it is impossible to alter or change the innisible Nature.*

Hip. oftenseth
the word soule
for heate.

An elegant
place of *Hip.*
concerning
the immorta-
lity of the
soule.

In his Booke *de morbo Sacro*, he affirmeth, that in the heart there is no wisedome or intelligence, all saith he is in the power of the Braine. From the Braine we vnderstand, doate and grow mad, as it is hotter, or dryer, or colder.

Galen in his 3. Booke *de Placitis Hip. & Plat.* conuinceth by many arguments that the brain is the seate of all the Animall faculties. And in the fourth Chapter of his third Booke *de locis affectis* according to the opinion of the vulgar he accounteth that man foolish that wanteth braines. For the further confirmation of this opinion we will adde an elegant argument of *Philo.*

Galen.

Wherefoener the Kings Guard is there is the person of the King whom they doe Guard; but the garde of the Soule, that is, all the organs and instruments of the Sences are placed in the head as it were in a Citadell or Sconce; there therefore doth the Soule keepe her Court,

Philo his argu-
ment.

there is her residence or Estate. If therefore the sensatiue faculty be placed in the Braine, the Intellectuall must be there also, because as saith the Philosopher the office of the Intellectuall faculty is to behold and contemplate the Phantasmes or Images which by the Senses are represented vnto it. We resolute and conclude therefore that the braine is the seate of all the Animall faculties as well Sensatiue as Principall.

QUEST. II.

Whether the Principall faculties haue distinct places in the Braine.



What a principal faculty is.

The opinion of the Arab. that they haue distinct seates.

The first argument.

The second.

The third.

Histories

Being therefore the Principall faculties are there: Imagination, Reason and Memory; and that their seate or habitation is resolute to be the braine: let vs now enquire whether they haue distinct & particular mansions provided for euery one of them. *Galen* in his Book *de Arte parua* defineth principall functions to be such as issue onely from a principle: and in the 2. *de locis affectis* he addeth. Which are accomplished by no other part as by an Organ and Instrument. And yet more plainly in the 7. Book *de placitis Hip. & Plat.* Which are only in the braine and thence doe proceed, not receiuing their operation from any other Organs of sense or motion.

The whole Schoole of the *Arabians* hath imagined certaine mansions in the braine, and assigneth to euery particular faculty a particular seate; & this is *Auicenna* his opinion, *Fen. 1. primi, doctrina, 6. Cap. 5.* As also *Auerroes* in his Canticles, his Book *de memoria & reminiscencia* and in *Colliget.*

They place therefore the Phantasie in the forward ventricles, Reason in the middle, and Memory in the hinder ventricle: and this opinion may be established by many arguments on this manner. Almost all the senses are placed in the forepart of the head, wherefore because the Imagination is to receiue and apprehend the species and representations of sensible things it must be placed in the forepart.

By the Imagination the Intellectuall power is stirred vp and abstracteth the Images of things from those Imaginations, and therefore it must bee situated next vnto the Phantasie; and because that is the most immediate Instrument of the reasonable Soule, it was fitte it should reside in the safest and most honourable place which is the middest, that is, the third ventricle.

This Intellectuall faculty commendeth those abstracted formes of things vnto the Memory, which it layeth vp as it were in a Treasury, and therefore the seate of the Memory must be in the hindmost and driest part of the braine which is the fourth ventricle.

Againe, the Imagination being a conception of Images, and accomplished onely by reception and simple apprehension, requireth the softer substance of the Braine wherein such sensation might be made. The Memory desireth the harder substance of the Braine that it might be able the longer to retaine those Notions which it storeth vp. Ratiotination is best pleased with a substance of a middle nature betwixt the softer and the harder. Now the forepart of the braine is the softer, the hinder part the harder, and the middest of a middle constitution; & therefore the Imagination is in the forward ventricles, Ratiotination in the middle, and Memory in the hindmost.

Thirdly, that these principall faculties are disclused or separated by their mansions these things doe demonstrate; because if one of them be offended yea or perish vterly, yet the other may remaine vntainted or vnaffected. For it oftentimes happens that the Imagination is viated & yet the Intellectuall faculty not at all deprauid. For the confirmation of this we haue many elegant Histories in *Galen*, as in the 3. chap. of his Book *de Symptomatum differentiis* and the 2. chap. of his 4. Book *de locis affectis*. *Theophylus* being otherwise able to discourse very well, had yet an Imagination that there were Fiddlers in the corner of his Chamber and continually cried to haue them thrust out. Another being Phreneticall lockt the doores of his Chamber to him and carried all the vessels to the Windows, where giuing euery vessell his proper name he asked those that passed by, whether they would command him to cast them out. *Thucydides* reporteth that when the plague was so hot throughout all *Gracia* and *Peloponnesus* that many which recovered did so vterly forget what they had known before, that they did not remember their Parents or familiar friends. In these men therefore only the Memory was offended; in *Theophylus* onely the Imagination, and in him that was Phreneticall onely the Intellectuall faculty or vnderstanding.

More-

Moreover, vnlesse the principall faculties had seuerall seats, why were there diuers ventricles or cauities made in the braine? And why is one of them more noble then another, vnlesse it be because it is the seat of a more noble faculty.

The 4. argu-
ments.

We will also adde an argument taken from the secrets of Physiognomy. They that haue a large Nowle or backpart of the head are said to haue happy memories: but when the forepart and the forehead doth set outward, the Imagination is the stronger. On the contrary, those that want both these processes are euen by the common people esteemed foolish Idiots: and this is the Philosophy of the Arabians concerning the seats of the faculties. Let vs now come vnto the Greek Family. *Galen* the Prince of this Sect conceiveth that the principall faculties are all established in one place, occupied about the same Images or Notions, do vse the same instrument, to wit, the braine; but their manner of working, saith he, is diuers. In the 8. Book *de vtu partium*, vnder the name *inymoria*, hee comprehenderh the three principall faculties and teacheth that they reside in the whole braine; and in the same book he saith that the principall faculties haue their residence or residence not only in the ventricles but also in the whole body of the braine.

The 5. argu-
ment.

The opinion of
Galen against
the Arabians.

For to what other purpose should the substance of the braine haue beene made so large and ample. In his third Booke *de Placitis Hippocratis & Platonis*, hee saith, that if one of the ventricles be offended, all the principall faculties are therewith affected. And this is confirmed by daily experience and the euent of things. For in the *Epilepsy* or falling sicknesse there is an intercepion of the minde and all the senses, and yet this obstruction doth not occupy all the ventricles. The Phrensie is an inflammation of the braine and his membranes. Now wee observe in this disease that sometimes Reason alone is peruered, sometimes the Imagination, sometimes the Memory: yet who will euer say that in the phrensie one ventricle onely is inflamed? In that kinde of *Melancholia* which proceedeth immediately from the braine and is a cold and dry distemper of the whole substance thereof, yet sometimes I say in that disease onely one faculty is depraued, sometimes the Reason sometimes the Imagination. Wherefore the principall faculties are diffused through all the ventricles & through the whole marrow of the braine. And though they are distinct one from the other, yet doe they exist together in the same particle of the subiect, for one and the same Soule performeth the offices of these different faculties by the vse of diuers meanes and a difference of Tempers. So in one and the same particle of a bone there are diuers faculties included, a drawing, a retaying, an assimilating and an expelling faculty. One of which, though it be affected when as oftentimes the rest are not tainted, yet a Physition will not therefore say that they are discluded in their seats and subiects. As therefore in the stomacke diuers faculties are offended by diuers distempers, the retaining faculty especially by a moyst distemper and the assimilating by a dry, yet are not these faculties separated in diuers parts of the stomacke: so with *Galen* wee think and determine concerning the principall faculties, that the whole substance of the braine is the seat of them all promiscuously disposed therein, which substance if it bee somewhat dry a man shall haue a faster Memory, if somewhat moyst his Imagination or fantasie will be the better.

Authorities.

Examples.

Inference vpon
the examples.

Comparison.

Obiection.

Answer.

They that follow the opinion of the Arabians doe obiection vnto vs that *Galen* is on their side, for in his Booke *De Oculis*, he placeth the phantasie in the forepart of the braine, Reason in the middest, and Memory in the hinder part. Wee answere that we thinke that Booke is not *Galen* but a bastard falsely fathered vpon him. They adde further that when the imagination is offended *Galen* applyed his remedies to the *Sinciput* and forepart of the head, because there is the seat of the Fantasy. But they doe not consider that *Galen* doth the very same almost in all diseases of the head, as the *Caros*, the *Apoplexy*, the *Phrensie* and *Melancholia*, in the twelfth of his Method and in the second Booke *De Medicamentis secundum locos*, and that not by the reason of the diuersity of seats, but that the force of the Medicine might sooner penetrate into the inner parts of the braine. For that which is applied to the forepart of the head pierceth deeper and sooner because of the thinnes of the skull in that place and the opennesse of the Coronal suture.

A 3. obiection
made.
Places of *Gal.*
for the Arabians.

That place of *Galen* in the second Chapter of his fourth Booke *de locis affectis* seemeth to make more for their purpose, where he writeth. *If when the forepart of the braine is offended, the third ventricle be affected by consent, then will the understanding be depraued.* He seemeth therefore to say that the vnderstanding is not vitiated vnlesse the third ventricle be offended. Again, in the 27. Commentary vpon the first Section *Porrhys*: *If a humor be fastned and stablisch in any part of the braine, those symptomes wil follow which are agreeable as well to the nature of the part*

Answers to
those places.

as to the humor, as for example. If the humor be established in the forepart it will breede a Phrensie in which the Imagination is offended. Hee addeth further. When the matter is transported in the braine out of one part into another, the disease will continew to be of the same kinde, but the symptoms will alter according to the part affected, as sometimes the Imagination will be offended, sometimes the Reason. We answered, that we thinke all the principall faculties are contained in the whole braine, but wee doe not deny but that one faculty is more manifest in one ventricle then it is in another, as the spirits are in this cavity more thin, perfect and better laboured then they are in another.

Obiection.

Finally they obiect, if the principall faculties be not seuered in their places and habitations, why is one ventricle more noble then another? For *Galen* in the 5. chap. of his 3. Book *de locis affectis*, and in the 8. *de usu partium* preferreth the hindmost ventricle to both the rest and the middle to the foremost. And againe in the 6. chap. of his 7. Book *de placitis Hip. & Plat.* hee writeth, that the wounds of the fore ventricles are dangerous, of the middle more dangerous, and of the hindmost most dangerous of all, which seemeth not to happen by reason of the structure, temperament or substance of the braine, because all these are in all places of the brain alike, but by reason of the faculties contained in the ventricles.

Answer.

Some answer that the 3. and 4. ventricles are more noble then the foreward, not because there resideth in these more noble faculties, but because in them the Animall spirit attaineth a further perfection; so that by how much the Liuer is more noble then the stomacke, the Heart then the Lungs, and the left ventricle of the Heart more excellent then the right, by so much and for the same respects the backward ventricles of the braine are more noble then the foreward.

The conclusion
of the ques-
tion.

We conclude therefore with *Galen*: that all the principal faculties do promiscuously inhabite in the same part of the braine together, that they vse the like corporeall Instrument, that is, the substance of the braine, yet they worke after a diuerse manner according to the variety of the Temperament and the Medium.

QUEST. III.

Whether the principall faculties doe depend upon the Temperament of the Braine or upon the Conformation, that is, whether they be similar or organical actions.

That the fa-
culties proceed
from the con-
formation.

Authorities.
The 1. reason.

The second.

The contrary
opinion.
Authorities.
Hippocrates.

Plato.

IT is a most obscure question whether the braine do vse reason and apprehend phantasmes because it is of such a temper, or because of the admirable structure it hath. Some haue conceiued that these faculties are performed only by the Conformation, which their opinion they confirme by authorities and by arguments. *Galen* writeth in his 7. Book *de placitis*, that the cause of wisdom in man is the variety of the structure of the braine and the magnitude thereof. The figure of the head according to *Hippocrates* and *Galen* if it be naturall, that is, sphericall or round, somewhat long, bunching somewhat out before and behind and depressed or flatted on the sides, is a signe of a wise man; and contrariwise a sharpe and Turbinated head like a sugarloafe, which they call *rogon* such as was *Thyr fies* head in *Homer*, is an argument of a dull or stolid foole. Again, all the principall faculties perish when the conformation or structure is vitiated although the Temperament be not yet vitiated, as in the Apoplexy, the Epilepsy and in wounds of the head when the ventricles of the braine are eyther stuffed or compressed. For in the cracking of the Scull, how can the Temperament of the Braine in a moment be altered, or else in the oppletion or filling of the ventricles by any humor? It appeareth therefore that the principall functions are performed only by the structure and conformation of the Braine, and that conformation being vitiated they are presently intercepted.

On the contrary there are others who thinke that the next & immediate cause of these principall faculties is the temper of the marrowy substance and of the spirits of the braine. Let vs heare *Hippocrates*, *Apollo* his eldest sonne and the pillar of the family of Physitians, in his first Book *de diata* teaching the same thing in plaine words. When in the body the dryest part that is the fier, and the moistest part that is the water, are equally tempered, then is a wise man borne.

And these are the words of the diuine *Plato* in *Theateto*. The soule is not wel disposed in a dense or muddy braine, neither yet in a soft or hard braine; for softnes makes men of quicke apprehension

but then they are forgetfull withall, hardnes makes better memories but dulnes of capacity & densi-
contayneth dusky and obscure phantasmes or images. Galen in his 8. Book *de usu partium* saith, *It* Galen.
is better to thinke that the understanding followeth not the variety of composition, but a laudable
temper of that body wherewith we understand: for the perfection of the understanding is not so much
to be attributed to the quantity of the spirits as to the quality. The same Galen in his Book *de Arte*
parua, referreth the causes of wit or capacity to the thick or thin substance of the braine.

This wit he calleth *αγχιμας*, that is, a working capacity, which is defined *ευσοφία*, that is, a
promptitude or readines of Inventing and coniecturing. In the same Book *ευσοφία*, that is, a
facility of learning sheweth a soft and moyst substance of the braine, and *δυσσοφία*, that is, an
ineptitude to learne, a dry and a hard braine. Those that are light witted and inconstant in their
opinions are for the most part of a hot braine, because heate is full of motion. But those that
are obstinate are of a cold braine because cold is sluggish, to which if you adde drought, then
will such men become stubborne and refractory, and hence it is for the most part that the
Authors and fautors or defenders of Schismes and Sects are Melancholy. Galen in his Booke
intituled *That the manners of the mind follow the temperature of the body*, calleth the Soule a con-
sent of qualities, and doth not distinguish it from the temperament.

In his Commentary vpon the 6. Book *Epidemion* and vpon the 6. Aphorisme of the 2. Se-
ction, as also in the 6. chap. of his Book *de locis affectis*, he sty leth the temperament of the brain
the *Minde*. For so he expoundeth that Aphorisme of Hippoc. Melancholy men become Epi-
lepticall and Epilepticall men Melancholy; as the humor ascendeth into this or that part so is
there a transmutation made of these diseases. For if the humor be transfused into the body &
ventricles of the braine then they become Epilepticall, if into the minde they become Melan-
cholicall; where by *Minde* he vnderstandeth the Temperament. For the disease called *Melan-*
choly is a cold and dry distemper of the braine. But when Galen called the Soule a Temper, he
doeth not conceiue that that Temper is the forme of a reasonable man, but the *forma medica*,
because that onely falleth into the Physitions consideration.

Galen calleth
the Soule a
temper.
how & why.

For that which can neither be preserued when it is present nor restored when it is absent,
that doth not at all belong vnto the Physition: but the intellectuall Soule can neither be pre-
serued being present nor restored being absent; onely the Temperament may be maintained
when we haue it, or restored when it is lost. The Temperament therefore only is the Physicall
forme of a man, because the Physition considereth a mans body not as it is Natural consisting
of Matter and Forme, but as it is subiect to sicknesse, and againe liable to Physicke. And from
hence some men doe imagine that it is sufficiently prooued that the principall faculties of the
soule are not exercised by the structure or conformation but by the temper of the braine.

Our opinion concerning this question is, that the efficient cause of all the functions is ney-
ther the Temper alone, nor onely the wonderfull structure of the braine; but the intellectuall
Soule which notwithstanding admitteth both these causes: one Organically which is the ampli-
tude or largeness of the braine and of the ventricles and the plenty of the spirits: the other si-
milar which is the Temper of the marrowy substance and of the spirits. From hence we gather
that *Raticionation*, that is, the vse of Reason is neither absolutely an Organically action because
it is impaired in those that are Melancholicall and Phreneticall, when the structure of the
braine is not at all violated; neither yet purely similar, because the braine is offended when his
ventricles are compressed or stuffed vp, all be the Temperament be not offended.

What wee re-
solue of.

Furthermore this *Raticionation* is neither inchoated nor perfected by the Temperament a-
lone, neither yet performed by any particle of the brain; but is an action mixed or compoun-
ded of an Organically and Similar, such as is the action of the heart and the stomacke. For the
heart indeed is moued and hath his pulsation from an ingenite faculty and proper Temper of
his own: But it could neither haue been contracted nor distended vnlesse it had been excaua-
ted or hollowed into ventricles.

QUEST. IV.

Of the vse of the braine against Aristotle.

IF euer that great interpreter of Nature Aristotle the Prince of the *Peripateticks*, doe
lesse sufficiently acquite himselfe, it is in the matter of Anatomy, and more especially
in that he hath written concerning the vse of the braine in the 7. chap. of his 2. Booke

The vse of the
braine after
Aristotle.

Aristotle
confuted.

A very strong
Argument.

The true vse
of the braine.

What Auerrhoes
opinion is.

But confuted.

Where these
questions are
disputed.

depart. *Animal*. where he cannot be redeemed from palpable absurdity. The braine, saith he, was only made to refrigerate the heart. First, because it is without blood and without veines; and againe because a mans braine is of all other creatures the largest, for that his heart is the hottest. This opinion of *Aristotle*, *Galen* in his 8. Booke *de v'su partium* confuteth by these arguments. First, seeing the braine is actually more hot then the most soulerie ayre in Summer, how shall it refrigerate or coole the heart? Shall it not rather be contempered by the inspiration of ayre, which it draweth in and as it were swalloweth from a full streame? If the *Peripateticks* shall say that the externall ayre is not sufficient to refrigerate the heart but that there is also required an inward bowell to assist it: I answer, that the braine is farre removed from the heart and walled in on euery side with the bones of the Scull. But surely if Nature had intended it for that vse, she would either have placed it in the Chest or at least not set so long a necke betweene them. The heele, saith *Galen*, hath more power to coole the heart then the braine: for when they are refrigerated or wet, the cold is presently communicated to the whole body, which hapneth not when men take cold on their heads. Beside, the braine is rather heated by the heart, then the heart cooled by the braine, because from the heart and the vmbles about it, there continually arise very hot vapors, which being naturally light do ascend upward. Adde hereto this strong Argument which viterly subuerteth the opinion of *Aristotle* and the *Peripateticks*. If the braine had beene onely made to coole the heart, what need had there bin of so admirable a structure? what vse is there of the 4. ventricles, the Chambered or Arched body, of the webs and textures of the Arteries, of the pine-glandule, of the Tunnel, of the Testicles and Buttocks, of the Spinal marrow and of the manifold propagations of the sinews?

Finally, if this were true that *Aristotle* affirmeth, then should the Lyon which is the hottest of all creatures (witness his continuall disposition to the Ague) haue had a larger braine then a man, and men because they are hotter should haue larger braines then women; which things because they abhorre from reason & sense, we doubt to not affirme that the brain was created for more noble and diuine imployments then to refrigerate the heart. The body therefore of the braine was built for the performance of the Animall, Sensatiue, Motiue and Principall functions, and it is hollowed into so many ventricles and furnished with so many textures and complications of vessels; for the auoyding of his excrements, for the preparation and perfection of the Animall spirits; besides, the Nerves serue as Organs to lead out the same Animall spirit together with the faculties or motion and sense vnto the senses and the whole body. *Auerrhoes* (*Aristotles* Ape and where occasion is giuen, a bitter detractor from Physitions) endeauoreth to excuse *Aristotle* and saith, That the braine doth therefore refrigerate the heart because it tempers the extreame heat of the vitall spirits. But let vs grant that the braine tempers some spirits, yet it will hardly temper the spirits of the heart and of the large arteries, if it at all temper those spirits which are contained in the substance and membranes of the braine; which spirits so tempered seeing they do not returne vnto the heart, how shall they temper the heat of the heart? *Alexander Benedictus* in the 20. chap. of his 4. Booke seemeth to follow the opinion of *Auerrhoes*. *Albertus Magnus* a man better stored with learning then honesty, although he be a *Peripatetick*, yet in this point he falleth from his Maister *Aristotle*, and saith in his 12. Booke *de Animal*. that the braine by his frigidity doth no more temper the heat of the heart then the ficcity or driness of the heart doth temper the moysture of the braine.

Whether the braine be the originall of the sinews?

Whether the Nerves be continued with the veines and Arteries?

Whether the Nerves be the Organs of sense and motion?

Whether the Nerves of motion differ from the Nerves of sense?

Why the sense may perish, the motion being not kindered, or on the contrary?

Whether the faculty alone or a spirit therewith doe passe by the Nerves?

By which part of the Nerue the inner or the viter, the spirit is derined.

All these questions and difficulties with their resolutions you must seeke for in the third part of our book of the vessels. The rest of the questions we now prosecute.

QUEST.

QUEST. V.

Whence it is, that when the right side of the Head or Braine is wounded or enflamed, a Convulsion falleth into the opposite parts.

WE haue a double Probleme heere to discusse. The first, how it commeth to passe, that when the right side of the head is wounded or enflamed, it oftentimes falleth out that the left parts of the body suffer Convulsion. The second, why one part of the braine being smitten or obstructed, it sometimes happeneth that the contrary side of the body is resolu'd or becommeth Paralyticall.

Both these questions haue in them many difficulties. For the affects or diseases almost of all the parts are communicated *ἁρτίῳ*, that is, by rectitude, not *ἀντιῳ*, that is, by Contrariety, because the right side with the right, and the left with the left are *ὁμοῦ*, that is, haue a similitude of substance. And therefore when the Spleene is affected the left side is pained, and when the Liuer is offended the right. And in the 2. Section of the first Booke *Epidemion*. The paines of the sides, as pleuresies and such like are *ἐκείῳ*, that is, on the same side; so also is the Tension or swelling of the *Hypochondria*, the tumor of the spleene & the bleeding at the nose. We will first therefore entreate of Convulsion and then of the Palsy.

That the opposite parts suffer Convulsion *Hippoc.* first of all men taught vs in his Booke *De vulner. Capitis*. By opposite parts he vnderstandeth the parts sometimes of the head alone, sometimes of the whole body. Of the head alone, whereas he writeth that the veines which runne through the temples are not to be opened, because there is daunger of convulsion, of the right side if the left veine be opened, and on the contrary.

Of that convulsion which affecteth the rest of the parts of the body, hee maketh mention in the same Booke. If (saith he) the Bone be purulent, then will Pustules arise in the tongue, then the patient wounded will dye idle-headed, and for the most part the other side of his body suffereth Convulsion, for if the right side of the head be wounded then will the Convulsion occupy the left part of the body, and on the contrary.

In the 5. Booke *Epidemion* he telleth of a wench whom he calleth *Puella Omilæ*, who had a bruise on the right side of her head in the middle of Summer and suffered convulsion on the left parts. *Antonius* had both his hands conuelled when hee was stricken with a stone in the middle of the *sciniput* or fore-part of the head about the mold.

In the 7. *Epidemion*. In the history of the sonnes of *Phanius* and *Euergetus* who were wounded in their heads. In such (saith he) it happeneth that they fall to vomiting and suffer Convulsions, and that in the left parts if the right side be wounded, and in the right if the left. Wherefore I gather out of *Hippocrates* these two things. First, that Convulsion doth not alwayes follow but onely when there is suppuration made, or whilst it is suppurating, or when there is a great inflammation. Againe, that all that are wounded doe not suffer Convulsion but the most, so that it is not perpetually or vniuersally true, that if one part bee wounded, the contrary part is conuelled.

To assigne the cause of the 1. convulsion it is not hard; for if the right temporall Muscle bee wounded or resolu'd, yet doth not a convulsion properly so call *primarily* and of it selfe fall vpon the opposite Muscle, but onely by event, because all the muscles are either *Antagonists* that is *Aduersary*, or *Congeneres* that is a *Kin*: if they bee *Congeneres* then the resolution or section of one causeth the convulsion of the other: but if they be contrary or *Aduersary* so that their motions succede one the other, then one of them perishing the other is necessarily taken away. For if the muscle which extendeth a part be cut, the part will indeed be bent, but it will so alwayes remaine; because it can no more be extended, and so the convulsion is accidentary and improperly so called.

But the nature of the other convulsion which is of the rest of the parts of the body not of the head alone, is much more obscure, notwithstanding *Hippocrates* in the places before quoted seemeth to acknowledge the cause to be the malignity of the *pneuma* or matter, which launcing the Membranes which are of an exquisite sense and pricking the original of the sinnew stirreth vp a depraued motion. Now there passeth from the wounded part into the sound part sometimes a breath alone, sometimes a portion of the malignant *ichor* or humor. The breath vapoureth a way thorough insensible passages, but how the *ichor* or thin humor should passe from the wounded part to the opposite side it is not easy to declare.

The affections of the parts are communicated according to Rectitude.

That the opposite parts are conuelled *Hip.* authority.

Many histories

Two things gathered out of *Hippocrates*

Why one temporall muscle is conuelled when the other is wounded.

The cause of opposite convulsion is a malignant quality.

How the Ichor
is carried out
of the sound
part into the
offended.

Instances.

Hippocrates.

Puella Omileas.

Two obscure
questions.

How the Ichor
passeth into the
opposite part.

Why the woun-
ded part is not
conuulsed.

It must needs bee either transmitted, or must fall downe, or be Propagated or finally Expressed. No man will say it is transmitted out of the wounded part into the sound, because the weaker part doth not vse to exonerate it selfe into the stronger; neyther doth it fall downe because all such sinking downward is perpendicular, that is, directly downward, for it followeth the motion of the humour, which motion seeing it dependeth vpon the Elementary forme, as Philosophers conclude it must be right and simple: wherefore it is eyther propagated or expressed, and both these I heere acknowledge. It is propagated if it abound in quantity; if the substance of it bee very thinne, if the quality bee verie sharpe: so Choler which is of Temper exceeding hot and raging when it breedeth an *Erysipylas* or Saint Anthonies fire in the inward parts, diffuseth it selfe sometimes euen to the outward parts also. So saith *Hippocrates* in a Squinsey of the *Larynx* or throtle, both the necke and top of the cheest are very red, *per erysipylas*, that is, by consequence or succession. What therefore shall hinder the diffusion of a thin Ichor through the whole membrane if the inflammation be come to his height? But if there bee not that plenty of Ichor that it can bee propagated, yet may there be made an Expression of it out of the right side into the left; and often there is from lower parts to the vpperward a *basitis*, that is, a Compression. Now Expression is made by compression, compression by suppuration, which whilest it is a making doeth distend the neighbour parts, because the working or boyling humour occupieth a greater place; and hence come paines and Agues in the time whilest the *Pus* or Matter is in confection, and therefore *Hippocrates* saith that conuulsion is especially then induced when suppuration is a making.

In *Puella Omileas* it is likely that the Ichor was not diffused, but expressed out of the wounded part into the part opposite. It may happen that a very little as it were droppe of the Ichor may moue a conuulsion, as also a venomous vapour, by goading the membranes of the nerues which are of most exquisite sence. Wherefore the humour which breedeth the conuulsion is oftentimes expressed or propagated from the diseased into the sound part, neither is it necessary alwayes that an Ichor should be expressed or propagated, it is sufficient if a malignant ayre breath out of it.

But heere wee obserue two things very obscure and intangled. First, how the Ichor can passe out of the wounded side into the contrary, seeing that the braine is distinguished into the right side and the left by a proper midriffe of his owne and that exceeding thick, which is a duplication of the *Dura Meninx* called the Sythe, because it is like a Mowing Sythe or Sicle? The other why when as the same acrimony of the *Pus* or quitture pricketh the membrane of the wounded part, it doth not stir vp conuulsion in the same but in the opposite part.

The dissolution of the former is fetched from Anatomy. The hard Membrane which toucheth the Skull in the vpper and Exterior part is wholly continuat and lined (as it were) or smeared ouer with a watry humour; betwixt it and the bone of the Skull is the purulent matter gathered, which may bee both Expressed and Propagated out of the right side into the left by the continuity of the Membrane, and furthered by the orbicular figure of the head.

A small portion of the Ichor expressed out of the affected into the sound side, sometimes by reason of the tenuity sweateth through the membranes into the marrow of the braine, and out of it into the nerues; whence comes their inflammation: sometimes by the outside of the membranes it falleth into the spinall marrow which is inuested with the same membrane, where goading the originall of the nerues it procureth a conuulsion by sympathy or consent, so that when the membranes are vellicated or enflamed a conuulsion sooner ensueth then if the internal or marrowy substance of the nerues were affected.

But why is the conuulsion not in the wounded but in the opposite part? It is obserued that sometimes when the right side of the head is wounded the right parts of the body are also conuulsed, sometimes the opposite parts only, oftentimes both together when (sain *Galen*) the inflammation toucheth the originall. It is not therefore perpetually true, that when one part of the head is wounded the opposite part is conuulsed, but because it hapneth so for the most part, let vs enquire the reason thereof.

The conuulsion is in the opposite not in the wounded part, because the purulent matter which is expressed or diffused out of the wounded into the sound part hath no issue but is there stabled or gathered and breedeth an inflammation; and from thence comes the conuulsion: but the *sanies* or matter which gathereth in the wounded part hath free egress by the wound and

and by the section of the bone, and so the Membrane is not affected. And this haply Hippoc. meaneth when in the history of that wench he said, that the left parts suffered convulsion because the contusion was on the right side. We may also assigne another reason of this convulsion and that very probable. The wounded part is not conuelled but the opposite, because the faculty of the wounded part is extinguished and dissolued, and the temperament which is the cause of all actions is notably depraued; wherefore though the faculty bee prouoked yet it answereth not, neyther doth any motion follow such prouocation, but the contrary part answereth the motion. Hippocrates. Another reason of it.

Now that vpon a suppuration or notable inflammation the part is almost mortified Hippoc. is witnesse in his booke *de vulneribus capitis*: but the opposite part hauing a quick sense is presently contracted and draweth into consent with it all the nerues of the same side; and so convulsion followeth *κατ' ἑν* by a rectitude of vessels. And this our coniecture the place of Hippoc. about named maketh good. For when the convulsion falleth vpon the opposite part then the case is desperate, pustules arise in the tongue, & the patient dyeth in a *delirium* or light phrensy. Hippocrates

QUEST. VI.

Why when the right side of the head is wounded or obstructed, the opposite part is resolved or becommeth Paralyticall.

Concerning the Palsy the difficulty is greater, the knot harder to cleare, namely, why when one part of the head is wounded or one of the ventricles of the braine obstructed or compressed, the opposite parts are resolved or become Paralyticall? That it is most true the examples are infinite, and all Physitions both ancient and moderne in their writings do agree vpon it. Hippocrates maketh mention of this kinde of Palsy in his booke *de vulneribus capitis* and in *Coacis praxionibus*. Those (saith he) that become impotent of wounds in their head do recover if an Ague without horror ouertake them, otherwise they become apoplecticall in the right parts or in the left; that is, paralyticall. For Hippocrates often calleth the leg taken with the Palsy *Crus Apoplecticum*. In the history of the sonnes of Phanius and Euergetus in his 7. booke *Epidemion* he writeth that they become impotent (if the wound be in the right part) on the left side, and on the right side if the wound were on the left part. Aretaeus in the 7. chap. of his 1. Booke *de Causis & signis diuturnorum morborum* is of the same minde. If (saith he) the head be wounded at first on the right part, the left side is resolved; if on the left, the right side. Salicetus setteth this downe for a Catholike or vniuersall Theoreme or *Maxime*. Whensoever any man is wounded in the head so that a Palsy happen thereupon, if the wound be in the right part of the head, the left side will be paralyticall and contrariwise. The same hath Iohannes de Vigo obserued: and Hollerius in his *Commentaries in Coacas praxiones Hippocratis*. And we also saith Laurentius, haue obserued the same. That the opposite parts are resolved, prouoked by authorities. A story out of Hippocrates.

Wherefore that it is so, there is no controuersie, all the question is, why and how it commeth so to passe, and that indeed is much disputed. Some imagine that the nerues in their originall are so implicated that the right nerues run along the left side, and the left along the right side, intersecting themselves in manner of a Saint Andrewes Crosse, which intersection is called *χιασμός*, and therefore it is, say they, that when the right part is obstructed or otherwise affected, the left side is conuelled or resolved, and on the contrary, because the originall is affected. And this is the opinion of Cassius and Aretaeus. Cassius thought that the nerues doe so take their originall from the Basis of the braine, that those which arose from the right part were carried into the left, and those which arose from the left side into the right, crossing one another ouerthwart. Aretaeus is of the same opinion. The right nerues, saith he, do not proceede directly into the right parts vnto their terminations; but as soone as they spring vp they cut ouer to the other side crossing one another like the letter X, which the Gracians call *χιασμός*. But the leuity of this opinion needeth no confutation. For ocular inspection which we call *αυτοψία* reacheth vs that all the nerues which arise out of the marrow of the braine are altogether distinguished and separated in their originall, progresse & insertion; excepting only the opticks which in the middle of their iourney do meet & that necessarily, that they might passe directly to the apple of the eye; that they might not grow flaccid or loose in their long iourney being very soft; that the simple and single object of the eye might not seeme double: and finally that the formes and Images of visible things might be vnited. Only therefore the optick nerues do meet, Divers opinions show this palsy commeth The first. Of Cassius and Aretaeus that the nerues crosse one another. Confuted. χιασμός. None but the opticks doe intersect.

meet, yet so that they neuer intersect or crosse one the other. We haue also of late obserued, saith *Laurentius*, that the nerues of the second coniugation haue beene continuall in their originall.

As for the nerues of the spinall marrow, the right are separated from the left, neuer cutting one ouerthwart another. It is therefore absurd to referre the cause of the convulsion and palsy which hapneth on the aduerse side to the intersection of the nerues and their Crosse permutation as *Aretæus* would haue it, because it is a meere fable.

The 2. opinion
that the spirits
passe by the ar-
teries which
intersect.

Some conceiue that not the Nerues, but the Veines and small Arteries of the Braine are implicated first in the Basis of the Braine, then in those two labyrinthian textures, the one called *Choroides*, the other *Rete mirabile*, so that they are diuaticated out of the right side into the left, and out of the left side into the right. They thinke therefore that when the Ventricle on the right side of the Braine, and the parts thereof are obstructed or compressed, the left side is conuelled or resolued because the entercourse of the Spirits is intercepted by the oppression or obstruction of their common fountaine, and at length by stopping of the way of the Spirit which they perswade themselves is communicated to the whole body by the Arteries not by the marrowey and inward substance of the Nerues. I cannot but acknowledge this conceit to bee very ingenuous and seemingly true if it were not that it is contradicted by the principles of Anatomy. For to winde vp the matter in a few words, this opinion taketh these two positions for good. First, that the Vessels doe intersect or crosse one another, and againe that the Animall Spirits are conuayed by Vessels not by the marrow of the nerues; which, how dissonant they are from the truth may thus be demonstrated by the two common and most competent Iudges of all Controuersies, reason and sence.

Confuted.

The diuatica-
tion of the ves-
sels of the
braine.

All the vessels which irrigate or water the whole body of the braine and his membranes are propagated from the internall Iugular veine and from the arteries called *Carotides* and *Cervicales*: now we are taught by *Autopsia* or ocular inspection, that the diuatication of these is on this manner.

The Sinus or
duplication of
the Dura Ma-
ter.

The right Iugular veine powreth the blood into the right sinus of the *dura mater* as it were into a Cisterne, and the left into the left; out of the *conuergent* or *Concourse* of these two ariseth the third Sinus, which running through the length of the sagittal suture is conuayed to the top of the nose, and from this many small veines are diuersly dispersed into the *pia mater*: the fourth Sinus concaued between the braine and the After-braine determineth at the buttocks of the Braine.

These Sinus as it were riuers substituted by Nature instead of vessels, doe disperse the blood on all hands, and from them as out of a presse, the blood arriuing vnto them from the Iugular veines, is expressed into the whole body of the braine. The Iugular veines therefore doe meete and vnite themselves in the third and fourth Sinus of the *Dura mater*, but yet are neuer so implicated that the right doe passe vnto the left side, or the left vnto the right; there is no intersection of these vessels, no *χιασμός*. Neither is there any intersection of the right *Carotidall* or *sleepy arteries* with the left, because they doe not powre vitall spirits into those Sinus or duplications of the membrane as the veines doe the blood, neither are the right implicated with the left, but each artery maketh his owne texture, the right artery the right texture and the left the left.

The arteries of
the braine doe
not intersect.

These textures or complications which are manifest in the vpper ventricles and called *Plexus Choroides* doe neuer so intersect themselves that the right should passe vnto the left, the left vnto the right parts, for the vpper Ventricles are disseuered by their proper wall or distinction.

Experience.

And if they say that the *Carotides* are implicated in the basis of the braine at the sides of the buttocks and there intersect themselves. I will indeed confesse that the arteries of the same side are implicated, that is, are contorted manifold like the tendrilles of a Vine crumpled vp together for the better preparation of the spirits: but that they intersect themselves and from the right side passe vnto the left, that I constantly deny. For the holes of the buttocks do stand off one from the other, through which the arteries ascend to the basis of the braine, and from them *κατ' ἑξῆς* or by a right line to the vpper ventricles: which he that will not otherwise beleue may thus proue by his owne experience. Put a hollow Probe of Bugle into the right *sleepy artery* and blow it, and you shall perceiue that the arteries of the right side will bee distended more then the arteries of the left. Let vs therefore cleare our conceits of this mist and cloud of error concerning the intersection of the vessels which *Autopsia* it selfe conuinceth to be a forged conceite.

Befide

Beside experience we have good reason also against it: for if we admit this interfection of the vessels, then it will necessarily follow, that whensoever the right parts are stuffed or compressed the left parts shall be resolved; because the course of the spirit is intercepted. But wee finde it often to fall out, that when the right Ventricle is obstructed the parts of the same side are resolved. But let vs for disputation sake admit (though wee doe not grant it) that those small Arteries and the complications of them do intersect one another, must it thereupon needs follow that when the vessels are compressed the Palsye should seize vpon the contrary side: The Arteries are onely conceptacles of the Vitall spirits. Those Vitall spirits do onely conferre their helpe to the cherishing, rowzing vp, and restoring of the in-bred heate of the particular parts, but affoord no helpe at all to Motion or Sense. Now in the palsy the part lieth though the Motion and Sense be both of them quite intercepted. Wherefore by the Arteries the Animall Spirit is not conueyed which is the Author of all Sense and Motion.

Reason.

The arteries do not conuey the animall spirits.

I know well that when the Iugular Veines and the Carotidall Arteries are obstructed, the Caros Apoplexy and Lethargy do follow; whence the Carotidall artery is called *Lethargical & Apoplectical*, and Hippocrates vseth to call that kinde of Apoplexy, *τὸν ἐκ τῆς ἀρτηρίας*, the inter-ception of the Veines: but this Apoplexy hapneth but by accident and is curable, wherein access is denyed to the vitall spirit which ministrerth matter to the Animall. But the Question in this place is of a true Palsy which happeneth vpon the exolution, made faction, and (that I may vse the Arabians word) Mollification of the Nerues, or when the wayes of the Animall spirits are shut vp or intercepted. These wayes are the Nerues, which albeit they haue no conspicuous cavity, yet is their inward substance altogether spongy, through which the Animall faculty and those impetuous spirits which Hippocrates calleth *τὰ ἐνδομυῖνα* do easily finde their way.

A light kinde of apoplexie whence.

Many learned men there are, who will not admit of this truth, and especially among the late writers *Rondeletius* striueth to proue that the Animall spirit is conueyed through the arteries not through the marrowy substance of the nerues: the only vse of the marrow he acknowledged to be, that like flockes it may sustaine and strengthen the smal and slender vessels. *Argenterius* also thinketh that the spirits neuer forsake the Arteries.

Rondeletius opinion that the animall spirits passed through the arteries.

It was an old opinion of *Praxagoras* as *Galen* remembreth in the seventh Chapter of his first Booke *De Placitis Hippocratis & Platonis*, that the Nerues were continued with the Arteries, and that the Nerues were nothing else but Arteries become now slender and small. But the weakenesse and insufficiencie of this opinion is hence conuined, because the Inter-costall Arteries are small and threddy, and the Arteries of the braine which make the two textures thereof as fine as haire, and yet no man euer durst call them Sinews. But of this we shall haue better occasion to dispute in our Booke of the vessels. In this place it shall bee sufficient to haue said that the Animall spirits cannot passe by the Arteries, because they were destined and ordained by Nature for the transportation of the Vitall spirits: now two spirits distinct in forme and kinde as wee vse to say, cannot bee conueyed by the same Vessels. When the Opticke Nerue is obstructed the action of the sight perisheth, are there then any small Arteries intercepted? Or is their interception the cause of blindness? Nothing lesse, for the part should bee vterly extinguished if it were no more illustrated with the beames of the Vitall spirits. Wherefore when the marrowy substance is affected, when the spondils or racke-bones are luxated the body is often resolved, because the marrow of the Nerue is pressed, by reason of which compression the passage of the Animall Spirit is intercluded.

Praxagoras opinion out of Galen.

Confuted.

That the animall spirits passe not by the arteries.

Diuers arguments.

In those that are afflicted with the Stone, the legge on the same side becommeth stupified, the Nerues and Muscles which are ordained to bend it being compressed by the Kidnie lying thereupon. As for those small Arteries which run thorough the Membranes that couer the Nerues they minister the Spirit of life vnto the Nerues, not the faculty of Sense and Motion. Againe, the Arteries of the Braine doe not essentially differ from Arteries, but other where the Arteries neyther engender nor containe Animall spirits, therefore not in the Braine.

Adde hereto, that the forme of every thing is stamped vpon the aliment and the spirit, onely by the substance of the part: now in those complications there is onely a power to prepare and as it were to delineate the spirits, their forme they haue onely from the Marrowy substance of the Braine. Finally, as the Braine by reason of this Marrowy substance is called the Braine, and this Marrow is the principall part of this noble Organ the seate of

of

of the Memory, Reason and Discourse: so I thinke that the chiefe part of the nerue is the marrow thereof, which carrieth the commandement of the Sensatiue and Motiue faculty, not only by irradiation but by a corporeall spirit. And therefore it is that *Galen* in his 8. Booke *de usu partium* calleth the braine *Nervum amplissimum & mollissimum*; A soft and large nerue; and againe he calleth a nerue *Cerebrum durius & resiccatum*, A hard and dried Braine. But if (as *Rondeletius* conceited) the inward part of the nerue had beene only ordayned for the establishing and sustaining of the small arteries ioyned to their membranes, then certainly is the Marrowy part of the nerue the basest and most ignoble.

Let therefore the opinion of *Galen* and of the ancients remaine with vs as current and canonicall, to wit, that the Animal spirits passe through the marrow of the nerves not through the arteries.

The cause of
the palse in
the opposite
part.

These things being thus established, it remaineth that we discover the cause of the Palsie which happeneth on the contrary side to the wounded or affected part. When the right part of the Head is wounded a portion of the *Ichor* may fall *anti ēv* by *Refirude* into the right fore ventricle; now out of it into the third (which is common) there is a manifest passage, (this ventricle *Galen* calleth the middle either because it is in the very center of the Braine, or else because it is situated betwixt the 2. vppermost and the 4. ventricle which is the lowest) and the humor contained in that ventricle is as it were in the center of the Braine. Wherefore if it follow the Motion of the Elementary forme it must fall into a lower place: now the sound part is alwayes the lower, because the patient euer leaneth or lyeth vpon the sound side not vpon the fore side for auoyding of paine. What therefore should hinder but that the humor may fall out of the 3. ventricle into the 4. and from thence into the spinall marrow on the opposite part vnto that which is wounded, and so that part become Paralyticall or resoluē? The Braine is not as some haue dreamt diuided from the top to the very bottome; the vpper ventricles determine into a common cavity into which they thrust down their superfluities. This common cavity is directed into the 4. ventricle which is common both to the after-braine & the spinall marrow. It is not therefore against our Anatomical principles or grounds, that *Matter, Flegme and Blood*, may be transmitted from the right ventricle to the 3. and from hence through the 4. ventricle into diuers parts of the spinall marrow, now into the right side and now into the left as either of them is lower or weaker.

Another reason.

Another reason also may be brought of the palse in the sound part not in the affected, because Nature vseth to auoid the excrementitious humor by the wound, as sometimes by a flux of blood, sometimes by quitture, sometimes by Medicines which draw away and exhaust the humor either sensibly or insensibly, so that the affected part is wel purged by some or more of these meanes; but the opposite part which is not expurged is easily affected either by sympathy or when the matter is transmitted or falleth vpon it.

Another?

Some think that almost all the spirits do flow to the part wherein the tumor or inflammation is, whence it is that the opposite part being defrauded of them is resoluē.

QUEST. VII.

What is the Nature of the Animall Spirit, what is the manner of his Generation and the place thereof.

WE haue sufficiently proued by strong Arguments that to Motion and Sense is required not onely an influence of a faculty but also of a corporeall spirit. Now what name we shall giue this spirit, what his nature is, what is the manner and place of his generation we will breifely declare.

What is the
animall spirit,
Galen.

Galen calleth this spirit euery where *Animalem* the Animall spirit, because the Soule vseth it as her immediate Organ for the performance of all the animall functions of sense and motion and those which we commonly call principall.

This spirit in the 17. Chap. of his 6. Booke *de Usu Partium* he defineth to be an exhalation of pure blood. Some thinke it to be a part of the liuing braine, yea both a Similar and an Organicall part: Similar as it hath a certaine and designed temper, Organicall as it is thin, lucid, subtile, pure and moueable.

This Spirit some haue thought doth not differ in kinde and Nature from the Vitall but onely in accidents, as in temperament, place, the originall *à quo*, and the manner of diffusion.

tion. For the Animall spirit is moyster and more temperate, the Vitall hotter. The Animall commeth from the braine, the Vitall from the heart; the Animall is dispersed through the nerues for Motion and Sence; the Vitall through the arteries to maintayne the life.

We are of opinion that these two spirits are of a diuerse forme and kinde, as Chylification is diuerse from Sanguification. For the Organs are diuers, the faculties diuers, diuers is the manner of Generation: and as the Aliment by a new concoction receiue a new forme and so a new denomination, so it is with the spirits. *Galen* in a thousand places distinguisheth this Animall from the Vitall spirit, whatsoever some new Writers say to the contrary. In the 5. Chapter of the 12. Booke of his Method: *The Animall spirit* (saith he) *ariseth out of the Brain as out of his fountaine.*

The demonstration of the Vitall spirit is not euident, but yet it is agreeable to reason that it is containd in the heart and the arteries. And if there bee any Naturall spirit, that is included in the Liuer and the veines. In the 7. Chap. of his 3. Booke *de locis affectis* *Galen* saith, *The Epilepsie* hapneth in the Braine when the humour hindreth the Animall spirit which is containd in the ventricles thereof that it cannot haue yssue out. In the 10. Chapter of his 16. Booke *de usu partium*. The complications of the arteries doe nourish the Animall spirit contained in the braine, which differeth much in Nature from other spirits. In the third Chapter of his 7. Booke *de placitis Hip. and Plat.* The spirit which is contained in the arteries is indeed Vitall and so is also called; that which is containd in the braine is Animall, not that it is the substance of the Soule, but because it is the Soules first and most immediate instrument. The same also hee writeth in the 4. Chapter of his 9. Booke *de usu partium*. In the 8. Chapter of the 9. Booke *de placitis Hip. & Plat.* and in the 5. Chapter of the ninth Booke *de utilitate respirationis.*

By all which places we may gather that *Galen* made a difference betweene the Vitall and the Animall spirits. And truely that there should be an Animall spirit it was very necessary; first to conuay vnto the parts the faculty of Motion and Sence which is not fixed in them; and againe that we might bee more apprehensie of outward accidents. For seeing that the Organs of the Sences ought to bee affected on the sudden by sensible things, it was fit they should not be altogether solide, but houed and fulfilled with spirits that they might the sooner be altered. Moreouer these spirits doe transerre the species or formes of all outward things perceiued by the outward Sences vnto the braine as vnto a Censor or Iudge. The same spirits doe conceiue in the braine the images of those outward thinges, so that the Animall spirit may be called the place and promptuarie of the species or formes. So in the *Vertigo* or *Giddinesse* neither the thing it selfe, nor the Image of it, nor any thing beside the spirit is rowled about, and yet notwithstanding all things seeme to him that is so affected to runne round. Wherefore this spirite is necessary both for motion and sence. As for the principall faculties, to the performance of all their functions the braine vseth the ministry and helpe of this spirit; so that it worketh both within the braine and without the braine: within the braine it helpeth the principall faculties; without the braine it conferreth Motion and Sence. Now it is not onely abiding in the ventricles but also in the pores and in the whole marrowey substance of the braine, so that in the pores and substance it is communicated to the principall faculties: In the ventricles it serueth more immediately for Sence and motion.

Furthermore this spirit which is the immediate Organ of Sence and Motion and of the principall faculties, is indeede of one kinde notwithstanding it is esteemed manifold according to the variety of the objects and instrumts where about it is imployed; which thing *Aristotle* elegantly hath taught vs in the last chapter of his 5. booke *de generatione Animalium*.

The spirit saith hee in Naturall things is like the hammer in the Art of the Smith, that is to say, but one instrument, yet profitable for the performance of many offices. *Aetnarius* compareth it to the beames of the Sunne, which though they bee all of one kinde yet they become vnlike when they light vpon different colours.

It remayneth now that we should manifest vnto you the Matter of the Animall spirit, and the manner of his generation.

The matter of it is double, Ayre and the Vitall spirit.

The Ayre is drawne in by the noethrills; the Vitall spirits are conuayed through the Arteries called *Carotides* and *Cervicales* into the basis of the braine. With this Ayre the spirit is nourished, and therefore *Galen* acknowledgeth a double vse of Respiration, to witte, the conseruation of Naturall heate and the Nutrition or Generation of the Animall spirits. Now if the passage of these two matters to the braine be intercepted, then will there be no generation

Yy

The vital and animal spirits differ in form & kinde.

Diuers places in *Galen*.

The necessity & vse of the animal spirit.

The nature of the *Vertigo*.

How the animal spirit is manifold.

The matter of the animal spirit.

tion of Animall spirits. If the *sleepy* arteries be bound an *Apoplexy* ensueth, if *Respiration* be prohibited, the Creature dyeth instantly and is deprived of Sence and Morion.

Containe places of *Galen* concerning the Animall spirit reconciled.

Galen concerning this poynt seemeth to differ from himselfe, but wee will reconcile those different places well enough. In the 5. Chapter of his booke *de usu Respirationis* he saith, that in a living creature he tyed the *Sleepy Arteries* and yet the creature perished not: therefore it followeth his Animall spirit was nourished onely with Ayre not with the vitall spirit. In his third booke *de placitis* and in the ninth booke *de usu partium*, he writeth that the Animall spirit may bee cherished and sustained with the vitall conueighed by the Arteries and maketh no mention at all of the Ayre.

Wee answer, that the Animall spirit may bee for a little time sustained if it bee deprived of cyther of his Aliments: for there is stored vp a supply against time of need in those two complications or textures called *Plexus Choroides* & *Rete mirabile*, but long that supply will not maintaine them.

Where the Animall spirit is prepared.

The preparation of this spirit is made in those Labyrinths of the small Arteries, their coction or elaboration (as some think) in the ventricles; and finally, their distribution into the whole body of the braine and into the sinewes.

They therefore are in an error who do conceiue that this spirit attaineth his proper forme and specifical difference in those textures. For all the complications of vessels as well in the braine as in the testicles and other parts are ordained onely for preparation, but the forme and difference of a thing is supplied by the substance of the part, both to the Aliment and to the spirit.

Where labored and perfected.

Wherefore we conclude, that in those complications the spirits are prepared, that in the ventricles they are boyled and labored, but receiue their vitermost perfection in the substance of the Braine.

QUEST. VIII.

Argenterius his opinion concerning the Animall spirit confuted.



Argenterius an acute Scholler indeed, but whose pen especially against *Galen* yeeldeth too much gall, in his booke *de somno et vigilia*, and in his Commentaries in *artem medicinalem* auoucheth, that there is but one spirit and that Vitall, neither will hee be brought to admit any Animall spirit at all. And first as his custome is, he inueigheth bitterly against his Maister *Galen* accusing him sometimes of leuity and inconstancy, sometimes of ignorance. Of inconstancy in his assignation of the matter and the place of the generation of the Animall spirit. In the matter, because sometimes he writeth that it is made of the ayre we breathe in, sometimes of the vitall spirits, sometimes of blood. In the place of generation, because hee assigneth it sometimes to bee generated in the Textures or complications of the Braine, sometimes in the forward ventricles, sometimes in the backward, sometimes that it is contained in the body and substance of the braine.

Argenterius accuseth *Galen* of inconstancy.

He vnderstandeth not *Galen*'s meaning.

But *Argenterius* his wit was too nimble to fasten vpon the depth of *Galen*'s iudgement, which if he had well attended he should not haue found repugnancy in him. For the most remote matter of the Animall spirit is blood, the neerer matter is vitall spirit, the neere of all is ayre inspired or breathed through the *mammillary* processes, and conueighed not into the textures but into the vpper ventricles. And as the matter, so also the place of their generation is manifold; for they are prepared in the Textures and vpper ventricles, boyled in the third and perfitted in the fourth or in the substance of the braine. Finally, they are diffused into the nerues, and from them conueighed into the body.

Galen accused of ignorance.

He accuseth *Galen* of ignorance, because from the *Net-like texture* he gathereth that there is an Animall spirit, because sayeth *Argenterius*, neither is the Texture conspicuous in a man, neyther is there alwayes required a complication of vessels where there is any spirit generated. For in the heart where the vitall spirit is abundantly generated there is no such admirable web of vessels.

But defended.

But *Argenterius* was so headily transported with a desire of contradiction, that hee did not obserue the tenor of *Galen*'s Argument; for he neuer concludeth that therefore there is an Animall spirit because in the braine the vessels are intangled and interbrayded one with another, but hee saith that this spirit is irrigated or watered and nourished by that which

that

that Net-like web supplyeth vnto it as we haue read in the 5. chapter of the 12. booke of his Method, and in his 7. booke *de placitis. Hip. et Plat.* and the third chapter. But let vs yeelde that *Galen* meant as *Argenterius* vnderstandeth him: shall wee therefore conclude that hee hath written absurdly? Nature is not wont to create any such texture vlesse it be for a new elaboration, but in the braine there appeareth a notable texture which we call *Choroïdes*, therefore in the braine there is preparation of a new spirit. *Argenterius* will obiect that in the left ventricle of the heart the vitall spirit is generated, and yet in the heart there is no complication of vessels.

Obiection.

We answer, that such Labiryntes were not necessary in the heart, because the necessity of the vitall spirit is greater then that of the Animall. And therefore there is a greater proportion of them required then can be confected in so narrow vessels. For the Animall functions are not perpetuall, and beside when a man sleepest they are also at rest. But for the vitall, the soulder we sleepest the stronger they are.

Answer.

Furthermore, all the parts of the creature haue not sence, as bones, gristles, and ligaments, yet all of them do liue. Wherefore because there is a greater exhaustion of vitall spirits their restauration must be *abrupt*, that is, sudden and plentifull. Adde hereto that the vitall spirit doth not onely serue for the accomplishment of the vitall function, but also is the matter of the Animall spirits: and therefore it is necessary that their generation should be in greates abundance, which cannot be accomplished in small Arteries and narrow cauities. Finally, the heart which is the hottest of all the bowels doth suddenly boyle & generate spirits albeit there be not so precise a contaction of all the parts; which thing the braine being far colder cannot performe, and therefore in the brain there was greates vse and necessity of complications of vessels and not in the heart. *Argenterius* proceedeth to goade *Galen* farther. Why are the Animall spirits generated in the complications of the Arteries of the brain, seeing the Arteries of the brain do not differ in kind from the arteries of the other parts of the body? Now in the other parts the arteries do not generate Animall spirits; therefore they shall not do it in the brain. I answer, that the Animal spirit doth not attain his forme & difference in the complications, but eyther in the ventricles or in the substance of the brain. In those straights and narrow passages it is only prepared, and attaineth a kind of rudiment or initiation by irradiation from the braine. So in the crooked rings of the preparing vessels the seed hath a delineation from an influence of the testicles. In the mesaraicks the blood is prepared by a vertue beaming from the Liuer: neyther did *Galen* euer acknowledge any other vse of those complications then the attenuation of the vitall spirit and the preparation of the animall.

Obiection.

Answer.

Fourthly, that there is no animall spirit he thus proueth. If in the brain a spirit were contained, then our sensation and cogitations should be perpetual, because the faculties of the soule are euer prest and at hand. I answer that the soule doth not alwayes worke though it haue an Organ; because the Organ is often hindred, as when the naturall heate is drawne inward, for example in sleepest. Again, there is not alwayes a sufficient supply of Animall spirits, and thence it is that the functions doe not alwayes worke, but sometimes rest themselves as in the night, in which time the spirits are redintegrated and refreshed; and this according to Physicians is the onely final cause of sleepest or rest. Fifthly, he obiecteth that though it should be granted that there is an Animall spirit, yet it cannot descend to the feete because it is of a fiery and airy Nature. But this argument is already answered thus: That all the spirits by their proper motion are carryed vpward and outward: but when they are directed by the soule they are diffused and dispersed into all the parts of the body. So the Arme being naturally heavy, is often times depressed by his Elementary forme, yet it is lifted vp againe by the soule; for our naturall heate is by diffusion communicated to all the parts. Sixtly, if there be more kindes of spirits, then (saith *Argenterius*) it will follow that they must be mingled and confounded, which confusion of the spirit, will also enduee eyther a confusion or nullity of the actions. But let vs grant (which yet is not true) that the spirits are confounded, will it thence follow that euery spirit shall not performe his owne office? Why may not the vitall do the offices of life and the Animall supply sence and motion? For these spirits are not contrary, that in the permission they should abate their power and force mutually. Seuenthly, he sayth, that the pupilla or apple of the eye is dilated by the spirit of the arteries which is vitall and not Animall. On the contrary, we thinke that when one eye is closed vp the apple of the other cannot in a moment be dilated by any spirits proceeding from the arteries, because the arteries of bothe eyes doe not meete and vnite themselves as do the optick nerues.

Argenterius. Argument. Answer.

The first answered.

The sixth

answered

The seventh

But there is a great distance betwixt them, and so great as that it is impossible that the Viual spirit together with the arteriall blood should so instantly moue it selfe from one eye to another.

The eight.

Eightly, hee objecteth that the influence of an Animall spirit is not necessarie, a quality onely or beaming light might be sufficient, for nothing that is corporall is moued in an instant. But we know that the Muscles obey the Brain according as our will commandeth them, for we are able in the twinkling of an eye to moue our vtmost ioynts. We answer that the spirit which is the Organ of the soule dooth instantly accomplish the commandement thereof and is euer adrest in the Nerues, and as it is spent repayed by new influence and succession; whence it is that before the exhaustion or expence of the olde a newe is ministrd to supply the roome. Which *Lucretius* in an elegant Verse hath thus chanted:

Answerd.

Ergo Animus cum sese ita commouet ut velit ire

Inque gredi, fert extemplo qua in corpore toto

Per membra atque artus animali dissita vis est:

Et facile est factu, quoniam coniuincta tenetur.

When the Soule listeth herselfe to disport,

The powers throughout the body disioyned,

Into the Ioynts and Members resort,

For the Soule holdeth them alwayes conioyned.

Argenterius
conclusion.

Finally, he concludeth that there is but one influent spirit because there is but one soule, one influent heat, one nourishment of the parts, to wit, the blood and one aire that is inspired. These are *Argenterius* Darts which he casteth against *Galen*, which how light they are and little sa- uouring of Physicke let the learned iudge. True it is that the soule is but one, but that one is furnished with diuers Faculties: there is but one Aliment, but by diuers concoction it recey- ueth a diuers forme, and that one according vnto the diuers substance of the parts is of di- uers sorts.

Our conclu-
sion.

As therefore there are three Faculties of the Soule, the Naturall, Vitall and Animall; three principles, the Braine, the Heart, and the Liuer; three Organs ministring vnto them, Veines, Arteries & Nerues: so are we to thinke that there are three spirites distinct in forme & kind, otherwise all thinges should be one because the common matter of all is one and the same.

Other reasons
to proue there
is no Animall
spirit.

There be other weapons farre keener then those of *Argenterius*, wherewith we may affront the opinion of *Galen* concerning the Animall spirit, which for disputation sake and that the truth may be better cleared we will thus vrge. Whatsoeuer spirit is contained in the Cavity of the Arteries is to bee accounted Vitall. But all the spirits contained in the Braine are included within the Arteries, neyther doe they euer yssue out of them, and therefore the spirits of the Braine are Vitall and not Animall.

The first.

The Minor proposition or assumption is thus confirmed. If the spirits boult out of the Arteries then are they conueyed either into the Ventricles or into the substance of the Braine, when if we admit, then will the spirit become presently condensed. For the scalding Vapors which arise into the Braine from the bowels boyling with extraordinarie heate are much thinner then the spirits and yet are instantly condensed or thickned.

The answer.

Now that the Vapor is thinner then the spirit may be prooued, because the vapour exha- leth outward, the spirits remaining within. To this argument we answer, that the Nature of Spirits and Vapors is diuers. The spirits are retained by the Soule, because they are familiar and as it were of Kin vnto her, but the Vapors are strangers or rather Enemies, and therefore they exhale and are condensed or thickned.

Another Reason.

The second.

If the Spirits of the braine do forsake the Arteries and be transfused into the Ventricles, seeing in the third Ventricle there are two passages, one forward and another backward, why doe they rather passe backward then forward? whereby shall it be conducted after it fall out of the Arteries so that it moue in a right line, and that without any violence but with an easie and gentle motion into the fourth Ventricle. I answer, that it is the Soule that direct- eth the Instruments of the soul, and that it is diffused into this part rather then into the other, because it is the Soules good pleasure so to command.

The third.

Answerd.

Thirdly, it seemeth not consonant to reason that a Spirit should be generated and contay- ned in the Ventricles of the Braine, because those Ventricles were ordained for the expurga- tion of superfluities. I answer, that Nature vseth one part for diuers vses, for as the Nose was primarily created for smelling and the inspiration of ayre, & secondarily for the expurgation of

of the Braine; so it may bee the forward ventricles of the braine were primarily made for the preparation of the spirits, and secondarily to auoide excrements.

Fourthly, that whereas one eye being shut, the apple of the other is dilated: It argueth that the spirits are not transported by the nerues but by the Arteries. For the optick nerues do not touch the apple of the eye, yea betwixt them are interposed many bodies and those very thicke, to wit, the Christalline and the Watrish humors, through which the spirits in such a moment cannot passe. For if it cannot passe through a drop of phlegme in the oppilation or stopping of the optick, which maketh the disease we call *Gutta serena*; how shall it passe the thicknesse of the Christalline humor? The spirit therefore yssueth through the small Arteries, which together with the *grape-like* coate are continued to the *Pupilla*. This reason would urge very much vnlesse Anatomy did teach vs that the opticke nerue when it cometh vnto the Christalline humor doth not there determine but is diffused and amplified into that coate which is called *Reticularis* or the Net. Now the *Net-like* coate passeth euen vnto the apple.

Finally, that there is no Animall spirit may thus be demonstrated. The spirits are those that do conueigh and transport all the faculties, and serue onely for that vse. Now there is no Animall faculty transported from the braine into the body, and therefore there is no Animall spirit. That the Animall faculty is not transported from the braine into the body may thus be prooued.

A faculty is a propriety of the soule, now euery propriety is inseparable from that thing whereof it is a propriety. Wherefore wherefoeuer the soule is, there also shall his faculties be. But we know that the soule is *Tota in toto et tota in qualibet parte*, that is, wholly in the whole and wholly in euery part. Whence it will follow, that the faculty is not onely in the braine but also in euery part of the body, and that as absolute and perfect as it is in the braine it selfe, because the whole soule is absolute and perfect in the least part.

The Philosopher makes answere, that the essence of the soule furnished with all her faculties is indeed euery where; but doth not worke euery where because euery where it hath not Organs. For the Soule doth not moue neyther partaketh all sense without the Animall spirit, as it seeth not without an eye.

We conclude therefore that there is an Animall spirit which receiueh an inchoation in the Textures, an elaboration in the ventricles, and a perfection in the substance of the braine, where also it is the vehicle of the principall faculties, and passing into the spinall marrow and the nerues is the immediate Organ of sense and motion.

QVST. IX.

Whether the braine be moued by a proper & In-bred faculty;
or by the motion of the Arteries.

IT is a very hard and difficult question whether the brain be moued by a proper and ingenit power of his owne, or by some outward violence. That the braine is moued no man in his right wits will deny vnlesse he be vtterly ignorant of Anatomy. For in great wounds of the head wherein the Scull is broken and the membranes are detected, there is a manifest motion to be seene. Againe, in children new borne the forepart which we call the mould of the head doth so conspicuously pant and beate, that the very bones of the Scull which at that time are exceeding soft are moued therewith.

But because among the Philosophers there is a threefold kinde of motion, the first naturall, the second Animall, and the third violent: It is a great question to which of these kindes the motion of the braine is to be referred. It seemeth to some that the braine cannot be the originall of the Animall motion vnlesse it selfe be moued voluntarily; for it were absurd to say that there yssued from the braine into the whole body a power or faculty which doth not reside therein as in the fountaine and originall.

But this opinion hauing no strength of argument to support it, hath also beene little ventilated by the Philistions. For an Animall motion is *proaireticall*, or with choice being intended, remitted or intermitted according to the arbitrement of our will. Now we know that the braine is not moued at our dispose, but according to it owne instinct, and therefore the motion thereof is not voluntary.

No man will say that it is violent; for *Aristotle* in his second booke *De ortu* opposeth that which is violent to that which is according to nature. It remaineth therefore that it is naturall,

The fourth

Answered

The fifth

Answered

That the
braine is mo-
ued voluntari-
ly.Disproued
That it is not
violent

rall. By naturall I vnderstand not that which is only directed by Nature, but whatsoeuer is not voluntary although it be gouerned by the soule.

Now whether this motion be of the whole braine or onely of the partes, or whether it be moued by an in-bred faculty ora power from without, that is, from the Arteries and the spirits, it is greatly controuerted. *Galen* in the second chapter of his fourth booke *de differentijs pulsuum* saith, that some thinke that the membranes onely do beate, others onely the body of the braine, others both the membranes and the braine it selfe. Some are of opinion that the Animall spirits onely are moued not the body of the braine, which they illustrate by the example of a *Vertigo* or giddinesse wherein all things seeme to runne round, because of an inordinate and Turbulent motion of the spirits. The vulgar opinion is that the braine is not moued by any proper motion of it owne, but by a motion from without, that is to say, from the Arteries. Neither do his ventricles breathe in aer, (as *Galen* would haue it) neyther are they distended and contracted.

The first opinion.

That the braine is moued according to the motion of the arteries Reason 1.

The reasons of this are: first it doth no more becomene a principle of motion to bee moued, then it becommeth a principle of sense it selfe to haue sense, because as *Aristotle* saith, euery instrument of sense must be destitute or void of all the objects of that sense whereof it is an instrument: now the body of the braine hath not sense and therefore it hath no motion.

Furthermore, if the braine doe breathe by a proper power, it would follow that because the substance thereof is soft, and the membranes that compass the ventricles very fine & thinne, it followeth I say, that that membrane must in the dilatation and contraction be violently torne asunder.

Thirdly, the third and fourth ventricles of the braine commonly so called, are of the same substance and temper that the vpper ventricles are of; for the vse of them all are one and the same; but it is granted that the latter ventricles doe not Respire, and therefore neyther shall the former be dilated or contracted.

They vrge further and thinke that this weapon hath a keener edge. In grieuous wounds of the head when the braine is vncovered, the motion of the braine and the arteries doeth not appeare to differ at all, but as one Pulse is answerable to another, so likewise the motion of the braine and the arteries doe accord. Now if the braine did beate by an in-bred power, then must it needes be that sometime the braine and the arteries should not beate alike and at the same instant.

Finally, there is no Attraction, no Expulsion without the helpe of fibres: so the heart hath his fibres, as also the stomacke, the guttes, the veines and the arteries; but in the braine there appeare no fibres at all; Ergo the Motion of the *Diastole* and *Systole* of the braine is not proper and peculiar vnto his substance.

Verily these reasons are so strong that the time hath bin (saith *Lauré*.) when I was conuinced by them and constrained to subscribe vnto this opinion; but looking ouer with a little more diligence the works of *Galen* and considering some passages in his Booke *de Odoratus Organorum*, *de vsu partium*, *de Placitis Hippoc. & Platonis*, with better deliberation, at length I altered my minde, and am now resolu'd that the body of the braine doeth respire by a proper faculty and in-bred Motion.

That the braine doth respire by it owne force.

The authority of *Galen*. Reason 1.

Let vs heare *Galen* disputing in expresse words in the last Chapter of his Booke *de Odoratus Organorum*, Nature, saith he, hath not denyed motion to the braine whereby it might draw Ayre for his refrigeration and retorne the same backe againe for the expurgation of superfluities. Again in the 4th Chapter of the same Booke, It is not impossible that the braine should yeeld vnto it selfe a kinde of Motion (though it be but small) sometimes into it selfe, sometimes out of it selfe, so that it should be lesse when it contracteth it selfe, and more spread when the parts of it are dilated. Thus saith *Galen*.

But it shall behooue vs to establish his authority by reason also and waight of argument. It is most certaine that the Animall spirit is generated first in the vpper ventricles of the braine, which spirit being of it owne Nature ayrie and hot, stood neede of the Inspiration of ayre which was familiar and of kin vnto it, as well for his nourishment as that by it it might be refrigerated: wherefore when we draw our breath inward, the ayre also is drawne into the braine, and when we breath outward, a fumid or smoaky vapour (which is the excrement of the Animall spirit) is thrust out and auoyded.

Hippocrates.

This *Hippocrates* elegantly expressed in his Booke *de morbo sacro* or of the Falling sicknesse. When (saith he) a man drawes in ayre by his mouth & his nose is shut, first of all the breath commeth

to the braine. Now this Inspiration of the ayre into the vpper ventricles of the braine and the Expiration of the same is not made by arteries, but by certaine protuberations or swelling productions of the braine much like the Nipples of a womans Pap, which also are the Organs of smelling. The Motion therefore of the braine which is accomplished by inspiration and Expiration proceedeth from the braine it selfe not from the arteries. Againc, that the ayre is drawne in by these productions may thus be proued.

The ayre and odours doe passe by one and the same way, for no smell can be felt although it be driven violently into the nose vnlesse therewith ayre be drawne in, now odors do passe into the braine by those productions before named, not by Arteries: and therefore by the same productions ayre is inspirated and transported into the forward ventricles.

Furthermore, if the braine do beate by the Arteries and not by an in-bred power for the generation of spirits; why then is not the spinall marrow also moued? You will say haply, that in the marrow of the backe there is not so great plenty of Arteries as are found in the braine it selfe. I answer, it may well be, for there is not the same quantity of matter or substance in the braine and the marrow. But if you compare both bodies together, then will the proportion of the Arteries be as great which runne through the membranes inuesting the marrow. Wherefore the spinall marrow is not therefore immoueable because it wanteth arteries, but because in it there is no generation of vitall spirits as there is in the Braine.

The third argument is on this manner. There is a certaine distance betwixt the body of the braine and the *Dura meninx*; not to giue way to the *Systole* and *Diastole* of the Arteries, for they are not so lifted vp; nor to auoid danger, because the *Pia mater* or thinne membrane is interposed betweene them: the distance therefore is left for the motion of the braine, and so we see that in the heart there is a distance betwixt it and the *pericardium*, least if they had touched one another the motion might haue beene interrupted.

Fourthly, how is it possible that so great a waight and masse of moysture, as the braine is, should bee dilated by a few small arteries? (for so I worthily call them that are sprinckled through the body of the Braine) seeing that the large and notable Arteries of the spleene are not able to moue his rare and smal body? I answer, Anatomy teacheth vs that this bowell is wouen with infinite Arteries, and yet no man euer saide that the spleene was moued vnlesse it be in a tumor or inflammation, and then any part will be moued.

Fiftly, if the motion of the braine be the motion of the Arteries and not of the marrowy substance, then it was ridiculous to say that the braine is moued because the Arteries are onely moued. For so we might say that the stomach, the guts and the spleene were moued because the Arteries do beate euery where. And therefore if we imagine that the marrow of the braine is distended by the *Diastole* of the Arteries, why should we not beleue also that all the rest of the parts of the body do beate, because they haue all proportionably as many Arteries?

Finally, the proceffe called *vermi-formis*, the *Conarion* and the buttocks of the braine doe shew that there is a peculiar morion of the braine which differeth from the motion of the Arteries. For the wormy proceffe being made shorter, openeth the way which is from the third vnto the fourth ventricle, and whilst the same proceffe is extended it shutteth the passage againe least the spirit should returne into the vpper ventricles: so that it seemeth there is the same vse thereof that there is of the valves placed at the mouth of the great Artery: now the opening and shutting of this clift proceedeth not from the Arteries, but from an in-bred power of the braine it selfe. It is therefore more probable to thinke with *Galen* that the braine is moued by a naturall motion and that proper to it selfe for the nutrition of Animall spirits, the tempering of them and their expurgation.

The reason and nature of this motion is on this manner. When the braine enlargeth it selfe it draweth ayre out of the nostrils by the mammillary processes and spirits out of the Textures or complications of the small Arteries. This ayre and those spirits it mingleth in that rest or *interim* which is betweene the two motions: but when in the *Systole* it contracteth it selfe the sides falling together, the inward ventricles are straightned and the Animall spirits powred out of the foremost into the hinder ventricles.

But here ariseth a scruple of no little moment, which is, whether the ayre is deriued to the braine when it is distended or when it is contracted? It should seeme that the ayre is drawn in in the contraction, because when the braine is contracted it departeth a little from the Scull: the Scull because it is immoueable doth not follow the contraction of the braine.

Reason 2.

Reason 3.

Reason 4.

Reason 5.

Reason 6.

The Conclusion.

The reason of the motion of the braine.

A great question.

It is therefore necessary that there must be a vacuitie betweene the braine and the Scull, or else there must be aire drawne in, wherewith the place must be filled.

What we
thinke.

But wee thinke that the aire is drawne into the dilatation of the braine, neither doe wee allow that there is any empiric place left in the contraction, because in the contraction there is an expression of aire and fumed vapours through the sutures. Now let vs giue answer to that which is objected against this our opinion.

The reason of
the contrary
opinions are
answered.
To the first.

They objected first. That the braine is the beginning of motion, and therefore ought not to be moued. We answer, That indeed it must not be moued with the same Motion wherewith it moueth the partes: It giueth to the partes of the body voluntary Motion, but it selfe is moued with a naturall Motion. The braine is moued after the same manner that it hath sense: Now the sense of it is naturall as is the sense of bones or the bowels, whereby it being prouoked, auoydeth that which is offensiu vnto it, as we may see in sneezing and in the falling sicknesse. It is moued for the generation of animall spirits.

To the se-
cond.

Their second argument was, that the ventricles of the braine did not respire, because in that perpetuall distension the thin Membrane of the braine would haue bin broken: But they do not remember that in sneezing and in the Epilepsie, the contraction of the Braine is more violent then the ordinary Motion; and yet in neyther of those is the Membrane broken. In Sternutation or sneezing, the Braine collecteth it selfe and is contracted, the better to exclude that which is offensiu vnto it. For the same that the cough is in the chest, and the hickocke in the stomach, the same is sneezing in the Braine. In the Epilepsie the whole Braine is contracted and corrugated.

To the third.

Thirdly, they obtrude vnto vs: that the backward ventricles do not respire, and therefore that the forward ventricles do not dilate or contract themselues. I answer, first that I know not by what flight or art they can perceiue that the backward ventricles do not moue. But let vs grant that they do not, yet is their consequence not good, for the formost ventricles doe stand in neede of more, at least of more conspicuous Motion then the other, because in the formost the spirit is prepared and purged, in the backward they are contracted when they are pure, sincere and already purged.

To the fourth

Fourthly, the motion of the braine and the arteries doth not appeare to be vnlike one the other. I answer, that they are not indeede vnlike, because their vse is the same, there is the same finall cause of generation of the spirits and of their expurgation.

To the fifth.

Fifthly, they doe not thinke it is moued with any proper motion, because there appeare in the braine no fibres at all. We answer, that the bones doe draw their nourishment, & expell that which is superfluous without the helpe of Fibres. Lastly, there is not the same reason or nature of the heart and of the Braine: for the Heart stood neede of Fibres not for the traction and expulsion of aire but of blood. In the *Diastole* the Heart draweth blood by the right Fibres, and the same blood it expelleth in the *Systole* by the transuerse. But the Braine when it is moued draweth aire with most thinne vitall spirits for the traction whereof there is no neede of the helpe of Fibres. Hence we thinke it is sufficiently manifest, that the Braine is moued by an in-bred facultie, and not onely by the motion of the arteries.

To the last.

Q V E S T. X.

Whether the Braine hath any sense.

That the
braine hath
sense.
The authori-
ty of Hippo-
crates.
Of Galen.

IT is a notable Controuersie amongst Physitians, whether the Brain haue any sense or no. That it hath sense it may bee demonstrated by authoritie, experience and reason. *Hippocrates* in his Booke *De vulneribus capitis*, resolueth that it hath sense where he saith, *That the braine above the finciput doth soonest and especially feele any inconuenience that is either in the flesh or in the bone.* *Galen* in his booke *De plenitudine*. The Braine (saith he) and the spinall marrow are accounted amongst those things which haue sense. And if in a frensie no paine bee felt, it is because the minde is disquieted. Againe in his booke *De Odoratus organo* he attributeth to the braine manifest sense. Moreouer experience and sense do confirme the same. *Galen* in the 4. chapter of the aforesaid booke, telleth a storie of a certaine man whom hee commanded to snuffe vp into his nose, and to receiue at his mouth *Nigella*, Githor Pepperwort finely beaten and mingled with old oyle, who thereupon felt a great gnawing in his braine. Which (saith he)

Experience.

Reason.

is a manifest argument that some of that *Nigella* went into the ventricles of the Braine, and cleaving to the *Pia mater* or thin Membrane, or else haply in the Braine it selfe, was the cause of that paine.

Again, reason seemeth to perswade the same. The Braine is the fountaine and originall of all sense, and therefore it selfe must need be sensible; because by it all other parts haue sense. For it is an axiome in Logicke, *Propter quod unumquodque est tale, & illud magis tale. That for which any thing is such or such, must needs it selfe be more such or such.* Furthermore, vnlesse the Braine haue sense, it could not rouse it selfe vp to the expulsion of that which is offensive: for in steruations or sneezings, and fits of the Epilepsie or falling sicknes, how should the Brain be moued and shaken to exclude and auoyde the humour or vapour by which it is vellicated or goaded vnlesse it felt the affluence thereof.

Contrarily, the opinion of those who determine that the Braine hath no sense, may also be confirmed by authoritie, experience and reason. *Aristotle* in the 17. chapter of his 3 booke *De historia Animalium*; And in the 7. chapter of his second booke *de partibus Animal*: writeth, that the Braine & the marrow haue not *sensum tactus* the sense of feeling. *Galen* in the 8. chapter of his first booke *De causis sympto*. The Braine (saith he) was ordained by nature, not to haue sense but to communicate the faculty of sensation to the instruments of the sense. In his third booke *De causis sympt*: hee calleth the Braine an Organe without sense.

Experience (then which nothing is more certain) conuinceth the truth of this position. For when the Braine is wounded the patient doth not feele although the substance thereof be pressed with a sharpe probe, ne nor if some of it be taken away, which thing is ordinary for Physicians and Chyrurgions to obserue.

Finally, it may be demonstrated by reasons. Euery Organ (saith the Philosopher) must be that is, without any extermall quality. So in the Christalline humor of the eye there is no colour, in the eare no sound, in the tongue no sauour; and the skin which is the Iudge of those qualities which moue the sense of touching, is it selfe of a moderate temper. So the braine is the seate of the common sense and iudgeth of all sensation, and therefore must it selfe be without sense.

Moreouer, the braine ought not to be sensible, for if it were hauing his scituation vppermost, and (like a cupping glasse) drawing and supping vppe the exhalations of the lower parts it would by their affluence perpetually be payned.

Finally, the substance well nigh of all the bowels is insensible, as of the liuer the spleene, the lungs, &c. and therefore the substance also of the braine is insensible.

To this opinion we rather subscribe then to the former, following therein *Galen* in his first booke *de causis Symp*: where he is not of opinion that the braine hath sense, but onely that it can discerne the differences of sensible things.

Those things which are brought to proue the contrary assertion, seeme to me to be very light. *Hippocrates* sayde that the braine did feele those iniuries that were in the flesh and in the bone, that is to say, it is affected and altered by them. So the same *Hippocrates* saith in his Aphorismes that the bones do feele the power of cold, that is, they are altered by cold. Wherefore he vseth y word Sense in that place abusiuely. *Galen* attributeth sense to the braine. It is true, yet not to his marrowy substance which is the fountaine and originall of all the Animall faculties, but to the *Pia mater* or thin membrane which insinuateth it selfe deeply into the conuolutions thereof. As for that logicall Axiome, it is only true in these causes which we call Homogeny, and those also conioyned. For the Sunne being of it selfe not hot, yet heateth all sublunary things. And whereas they say that the braine is shaken in the exclusion of that which is hurtfull, and thence would proue that it is sensible; we answer, that there is seated in euery particullar part a naturall power to expell that which is hurtfull; which power is sometime ioyned with Animall sense, sometimes also it is without the same. So the bones haue a power of excretion, and the flesh almost of all the bowles being insensible, is yet apprehensue of those things that are hurtfull, yea to expell them also and driue them forth. There are in the nature of things certaine *Sympathies* and *Antipathies*.

Fernelius in the tenth Chapter of the 5. booke of his *Physiologia* hath deuised a new and vncouth opinion concerning the motion and sense of the braine: He conceiueth that all motion is from the marrow of the braine, and all sense (saith he) floweth from the Meninges or Membranes: because the body of the braine is perpetually moued, and yet hath no sense at all; on the other side the membranes that incompasse it are of themselves immouable, especially the *Dura mater*, and yet their sense is most exquisite. So in the discase

The contrary opinion.
Aristotle
Galen.

Experience.

Reasons.

Answers to the Arguments of the former opinion.

How the braine apprehendeth that which is hurtfull.

Fernelius new opinion.

ease which wee call *Delirium*, that is, an aberration of the minde, and in the Letargy which are affects of the Braine there is no paine at all: but if a sharpe humor or vapour be transported into the Membranes, then is the patient as it were on the racke.

Furthermore, the spine and all the nerues haue their marrow from the braine and the same inuicted with membranes: all which haue the same power and nature which they receaued from their originall. Therefore the fore-part of the braine is the originall of sense, the back-part the beginning of motion, and the meninges or membranes are the beginning of touching. Those nerues that are fullest of marrow are the instruments of motion, but those are the instruments of touching which are for the most part deriued from the meninges.

Fernelius his
first error.

These are *Fernelius* words, wherein, saith my Author, by the fauer of so great a man, I find some things that cannot be warranted. First, he saith that all voluntary motion floweth from the Marrow because the Marrow is perpetually moued, as if the motion of the Braine and of the Nerues and Muscles were alike. The motion of the Braine is Naturall consisting of a *Diastole*, a double rest and a *Systole* for the generation of Animall spirits, but the motion of the Muscles and the Nerues is voluntary.

Second.

Furthermore, we are not to thinke that the Nerues are so much the fitter for motion by how much they haue more marrow; rather we beleue the contrary, that the harder Nerues are fitter for motion and the softer for sense, because sensation is a passion but motion an action; we know also by experience that the Opticke Nerue which is the softest of all the Nerues hath more Marrowy substance then the Nerue of the second Coniugation, yet the Opticke is the Nerue of Sense, the other the Nerue of Motion.

The authority
of *Galen*.

Add heereto, that Motion should bee rather ascribed to the Membranes then to the Marrow, because the Marrow melteth away, but the Membrane is stretched and contracted: so the Nerues of children are weake and soft and vnfit for motion. To all these let vs add the authority of *Galen* in the the third chap. of his second Booke *de Placitis Hip. & Platonis*, where he saith, that the faculties of Motion and Sense are only contained in the Marrow of the Braine & that the Membranes were made to cloath & nourish the Marrow & for no other vse.

The Braine
hath neyther
sense nor mo-
tion, and yet
is the originall
of both.

We conceiue therefore that this Paradox although it be witty, it will not holde at the Touchstone, and therefore we determine that the Marrow of the Braine is without all sense and Animall motion, and yet is the fountaine and originall of all Animall Sense, and motion. Of Sense, because it perceiueth the representations and receyueth the impressions of all sensible things. Of Motion, because it dispenseth and affoordeth all that power and command for the auoyding of that which is noxious, and prosecution of thar which is profitable; from whence it commeth to passe that when the Braine is il affected the inferior parts haue neither Sense nor Motion.

QUEST. XI.

Of the Temperament of the Braine.

Reconciliation
of *Aristotle* &
Galen.

THE Physitians and the *Peripatetikes* in this do agree, that the braine in the Actiue qualities is cold, in the Passiue moyft. But herein they differ, that *Aristotle* in the seventh Chapter of his second booke *De partib. Animalium* and in the fifth Chapter of his booke *De Somno & Vigilia*, determines that the braine is actually cold and ordained to refrigerate or coole the heart. Contrariwise, the Physitians say that it is Actually hot. For *Galen* in his eight booke *De Placitis Hip. & Platonis* saith, the brain is hotter then the most fowltry aer in summer. Some there are that do thus reconcile *Galen* and *Aristotle*; There is (say they) a double temperament of the braine, the one In-bred, the other Influent: by the In-bred temper, the proper composition and the marrowy substance, the braine is very cold; but by the influent temper it is hot, for it is full of spirits and intertexted with very many small Arteries.

If you respect the in-bred temper, then is the temperament of the braine and the spinall marrow one and the same, because they haue the same marrowy substance. If you respect the Influent temper, then saith *Galen* in the ninth chapter of his second booke *De Temperam.* the braine is hotter then the spinall marrow, as well because there passe vnto it more Arteries, as also because many fumid exhalations do ascend vnto it. Some say, that the braine is simply and absolutely hot; but colde comparatiuely, because it is the coldest of all the bowels. And *Galen* in *Arte medica* writeth, That a hot braine is colder then the coldest heate. In which respect *Hippocrates* in his booke *de Glandulis* calleth the

the braine *μῆλον τοῦ θυμῶν* the *Seate of Coldnesse*. But I cannot approve this opinion. For if the braine be colder then the skinn which is in a meane betwixt the extremes, then it is simply cold and not hot. Now that it is colder then the skinn *Galen* teacheth in his second booke *de Temperamentis*.

It will bee objected, that if the braine bee laide bare it will presently bee refrigerated by the aer, whereas the skinn is not affected therewith. I answer, that the braine is altered by the aer, because it is not accustomed thereto as the skinn is; so the Teeth because they are accustomed to the aire doe not grow blacke as other bones do if they bee layde bare. Or againe, that the braine is hotter to feele to then the skinn, because it is covered with the scull and the membrane and hath many complications of arteries therein. We determine therefore that the Braine of his in-bred temper is colder then the skin, but by his influent temper is hotter. That the Braine should be colde it was very necessary, least a Member set apart for continuall cogitation or discourse should bee enflamed and set on fire. Againe, that the animall spirits which are very fine and subtil might bee retained and not vanish away. Finally, that our Motions and sensations should not be rash or phanaticall as they are in such as are phreneticall, that is, haue their braines inflamed. It may be objected, if the Braine be cold, how then doth it ingender animal and attenuate vitall spirits; for these are the workes of a vehement heate? I answer, that the spirits are attenuated in the textures of the small arteries, and in the strayghtes of those passages: and that the animall spirit is framed not so much by any manifest qualitie such as is heate, as by an in-bred and hidden proprietie.

Objection.

Solution.

Why the
braine ought
to be cold.Objection.
Solutions

But the reason why the spirits of the extreame hote Heart are thicker then those of the very cold Braine must not be referred to the weakenesse of the heate which is the worker, but to the disposition of the matter which is the sufferer. For the heart maketh vitall spirits of thicke blood brought vnto it through the hollow veine: the Braine maketh Animall spirits of subtil and thinne vitall blood and spirits: so a weaker heate boyleth a thinne and easily concocted aliment, whereas a very strong heate will hardly overcome a thicke aliment. It remaineth therefore that in the active qualities the braine is cold.

Why the spi-
rits of the ex-
treame hot
heart are thicke
then the
Animall spi-
rits.

That in the passive qualities it is moyst both by the in-bred and influent temper no man I thinke is vnresolved: for it appeareth euen to the touch. Now it was by nature created moyst, as well for more perfect sensation, (for sensation is a passion; and those things that are moyst do more easily receiue the images and representations of things offered vnto them) as also for the originall and propagation of the nerues which would not haue beene so flexible if the braine had beene hard. Adde heereto that if the braine had beene hard it had also beene heavy and the waight and hardnesse thereof would haue beene offensive to the sinewes.

Why the
braine was
made moist.

Finally, it was made moyst least being a member destined to perpetuall motion sensation and cogitation, it should haue beene inflamed if the moysture had not beene an impediment thereto. But if you compare the two qualities together then we say that the braine is more moyst then cold: for amongst the moyst parts it hath a third place, amongst the cold parts almost the last.

QUEST. XII.

How many and what are the Excrements of the Braine, and by what wayes they are purged.



THE Braine being of a medullous or marrowey substance and by his naturall temper cold and moyst because it is nourished with flegmaticke blood, heapeth together abondance of excrements.

Why the
braine aboundeth
with ex-
crements.

Moreover, being as it were the Chimney of the whole body, or the head of a Still (whose figure also it representeth) it sucketh and draweth from the lower part, all kinds of expirations as *Hippocrates* teacheth in his Booke *de Glandulis* wherevpon it becommeth filled with vapors and as it were drunke with their continuall affluence and so stableth in it selfe a masse of superfluity; so that it aboundeth with excrements as well of it selfe, that is, of it own nature because it is cold and moyst, as also by euent for that it is seated in the vppermost place whither all vapors doe resort.

These

Thicke.

Thinne.

These excrements of the braine, if wee beleue *Hippocrates* and *Galen* are of two sorts, some are thinne and some are thicke; the thinne like vapour or soote doe expire or exhale vpward by insensible passages; the thicke are purged downward by open and conspicuous wayes. With the thinne and vaporious exhalations the braine is cloyed onely by reason of his situation, for all fumes doe arise vpward; and beside all vessels doe determine in the head. But it aboundeth with these crasse and thicke excrements about other bowelles by reason of the cold and moyst temper thereof.

The kinds of thicke excrements.

Of these thicke excrements some are phlegmaticke, waterish and ferous; some are bilious, some melancholy. The waterish are generated of the reliques of the phlegmaticke and crude blood: the bilious or melancholy out of the earthy portion of the Aliment torried by the violence of heate, and therefore they grow bitter.

Argenterius his error concerning the phlegmatick excrements of the braine.

Argenterius is of opinion that that waterish and mucous humour which is auoyded partly by the nose partly by the mouth and pallar, is not the proper excrement of the brayne, because many men and women doe seldome or neuer spit, and as seldome auoyd the moisture by the nose; but saith it is a humour ingendred in the liuer, mixed with the blood and contained in the veines, not generated in the braine vpon the concoction of the Aliment, but is thither conueyed from below: and because through the weaknes of the concoction and cold distemper it cannot bee assimilated by the braine, it returneth back againe as a redundancie or superfluitie and is cast out by the mouth and by the nose. Which assertion of his if it were true, what reason had nature to place in the saddle or seate of the wedge-bone that kernelly and spongie flesh? Was it not appoynted to receiue this very excrement? If this phlegmaticke humor were onely generated in an intemperate braine, what vse were there of the glandule which is found in all braines though most temperate? Nature is too wise and prouident so rashly to frame any part where there shall not be continuall vse thereof. In this opinion therefore of *Argenterius* wee can finde no vse either for the *Tunnell* or the *phlegmaticke Glandule* if the braine be not distempered. Moreover, it is not true that he saith, that those whose braines are temperate doe not spit phlegme or auoyde mucous matter by their nose: for *Galen* in the 13. Chap. *Artis parue* teacheth, that in a braine which is most temperate the excrements that are purged by the nose and by the pallate (such as are waterish and mucous excrements) are in moderate quantity: neither are wee to attribute it vnto perfect sanity when we finde those excrements by the passages not to bee auoyded. Wherefore we conclude against *Argenterius* that those phlegmatick and mucous humors are the proper excrements of the braine, because in the braine they haue peculiar conueyances and channels by which they are auoyded, framed by Nature onely for their euacuation.

Confuted.

Having thus determined concerning the differences of the excrements of the braine, let vs now see by what passages euery of these excrements are auoyded.

By what waies the thinne excrements breathe out.

The thinne and fuliginous excrements arising vpward because of their leuitie, doe expire or breathe out through the Meninges, the Skull and the Skin. Through the Meninges and the Skinne not by any sensible or conspicuous way but by insensible exhalation; for their bodies while a man is aliue are infinitely perforated or at least peruious with many small holes. But these sooty vapors because they could not passe the thicknesse and density of the bones, therefore is the Skull distinguished with sutures or seames, so that it consisteth not of one bone but of diuers ioyned together by those sutures, through which as also through the holes which are thrilled betwixt the tables of the Skull these thinne excrements and fuliginous vapors doe exhale.

The waies of the thicke excrements,

Hippocrates.

But the thicker excrements descending dwneward by the Naturall and Elementary forme, haue manifest and conspicuous passages, concerning which Physitions doe not so perfectly agree among themselves; *Hippocrates* in his Booke *de locis in homine* and *de glandulis*, acknowledgeth seauen wayes by which the humour passeth out of the braine, that is through the nose, the eares, the eyes, the pallar, into the throat and gullet through the veines, into the spinall marrow and into the blood.

Galen.

Galen in his 13. Chapter *Artis parue*, saith, there are foure passages, the pallar, the nose, the eares and the eyes. The same also he saith in the third Chapter of his second Booke *de locis affectis*, and in his first Booke *de sanitate tuenda*: but in his Commentary vpon the 21. Aphorisme of the first Section, hee nameth onely the pallate and the nose, as also in the first Chapter of his 9. Booke *de usu partium*, where hee saith, the passages of the braine which bend downward doe send out the thicke excrements as well by the pallate into the mouth

mouth, as also by the body of the Nofethrils, and these passages are large and conspicuous. In his first Booke *de symp. Causis* and the 8. *de usu partium* he saith, that the pallate alone is the fit way of expurgation when the creature hath good concoction, and that nofethrils do onely serue for the inspiration of aer and odours.

In his Commentary vpon the 24. Aphorisme of the third Section hee writeth, That the expurgation which is made by the eares is not Naturall vnlesse it bee in little children by whose eares we often obserue that their braines are purged.

In his Commentary vpon the 20. Prognost. of the first Section he saith, that the expurgation by the eyes is not naturall. Thus *Galen* seemeth to be of a diuers opinion concerning these passages of the braines excrements. But that we may reconcile these different places and freely professe what truely we are to resolute of; we thinke that the diuers excrements of the braine, Phlegmaticke, bilious and melancholicke are purged by diuers wayes, some of which are ordinary, familiar and accustomed to Nature, others extraordinary and not so conuenient.

The ordinary passages prepared for the expurgation of Flegme are the pallate and the nofethrils; but the pallate especially, because the Noftrils were primarily appointed for smelling. Anatomy teaches vs that out of the third Ventricle of the Braine there is a conspicuous passage to the inward Basis thereof, in whose extremity there appeareth a small portion of the thin Membrane which is first broader then groweth narrower like a Tunnell which the Grecians call *πυλὸν καὶ κοάνη*. The Latines *Peluis* and *infundibulum*. The Basin or Tunnell, through which the Flegmaticke humor is by little and little transcolated as it were through an *Hippocras* bagge. This waterish humor is receiued by a flegmaticke Glandule like a sponge, and afterward distilleth by degrees through the holes of the Wedge-bone into the pallar and mouth. But if at any time (which is not vnusuall) the vpper Ventricles of the Braine grow full of a mucous slime it droppeth through the proccesses which are like to the nipples of a womans paps into the *Os Cribiforme*, or spongy bone, and so into the Nofethrils.

The bilious excrements are continually purged by the eares. Some say that therefore the bilious excrements are throwne out by the eares that the heate and ficcitie thereof might keepe the bones of the eares dry and so more fit to receiue and report the sound. But the Phlegmaticke excrements are purged by the mouth and nofethrils, that those open passages by that humidity might be kept from drying vp. These therefore are the ordinary channels and most familiar to nature by which she purgeth the excrements of the Braine. There are also other extraordinarie wayes by which the Braine oppressed or surcharged with abundance of humor exonerateth it selfe. Such are the eyes, the Spinall Marrow and the Nerues from whence commeth the Palsie. There is also sometime a fall of humors through the Veines and arteries into the *Parotidas* that is the Glandules behinde the eares. But these are not the peculiar excrements of the braine, that is, of the Marrowy substance and of the Ventricles, but rather of the vessels as Veines and Arteries from whence proceed tumors of the glandules, inflammations likewise of the eyes and of the eares.

Now these excrements in a temperate Braine are moderate in their substance, quantity, quality and time of excretion. In the substance, because they are neither too thicke nor too fluid; in their quantity because they do not abound; in their quality because they are neither salt nor sharpe; in the time of excretion when they are auoyded after concoction.

There remaineth one scruple to be resolved, that is, by what wayes the superfluities of the *Cerebellum* and of the fourth ventricle are purged. We say for answer that the excrements of the *Cerebellum* and of the fourth ventricle are very fewe; as well because of the hardnesse of the *Cerebellum*, as also because in the fourth ventricle are contained most subtile, pure and well purged spirits, and therefore those few superfluities are easily dissipated. But the braine it selfe being in quantity very great and of temper very moyste heapeth vp abundance of superfluities which stand in neede of conspicuous passages by which they should be auoyded.

Places in
Galen
reconciled.

Some passages
ordinary,
some extraor-
dinary.

The wayes of
the Phlegme.

The Bilious
by the eares.

The extraor-
dinary passas
ges.

By what pas-
sages the su-
perfluities of
the after brain
and the fourth
ventricle are
auoyded.

ZZ Quest.

QUEST. XIII.

Of the number and vse of the Ventracles.

Of the num-
ber of the ven-
tricles.

IN the History of the Ventracles of the braine there are many things controuerted which offer themselves to our consideration; and first of all the Anatomists doe differ concerning their number. *Galen* determineth that there are foure, two *superior* which he calleth *anterior ventricles*; the middle which is a common cavity and the backward. *Auicenna* numbrell but three; the vpper, the middle and the hindmost; esteeming the vpper two for one, because they haue the same figure, magnitude, seite, structure and vse. *Arantius* addeth 2. other vnder these which he nameth from the fig. *Hippochampi*; but I think that they are parts of the vpper ventricles, which indeed are so large that in common dissections scarce their third part is shewne. *Varolius* cutting the brain after a new manner sayeth there are but two; but because we haue at large made mention of his opinion in the Historie foregoing, we will not here weary our Reader with iteration thereof, but referre him thither for further satisfaction.

Of the vse of
the ventricles.*Galen* redeem-
ed.

Objection.

Solution.

The opinion
of some new
writers.

Concerning the vse of the ventricles, *Vesalius* taketh *Galen* about the vse of the vppermost two; because he sayth that they are the organs of smelling and that out of these by certain processes the phlegme is transcolated into the spongy bones. Wee answer for *Galen*, that the *anterior* ventricles are therefore called the Organs of smelling, because vnto them are odours brought of which also they iudge. Beside, what should hinder that the flegme (if the braine abound therewith) should not be transported from them by those processes into the spongy bones; seeing we find that sometimes (as in the *Apoplexie*) the phlegme is diffused through the whole body of the braine; and sometimes falleth into the nerues and the spinall marrow as in the Palsie? It will be objected that the sense of smelling would be extinguished if the phlegme should be transcolated by these processes: I answer, that sometimes when the Fluxe is continuall and the humor very abundant the smelling is lost, not so much by reason of the obstruction of the processes, as because the holes of the bone are intercluded.

Some new writers there are who thinke that the *anterior* ventricles were not appointed for the preparation and concoction of the spirits, as well because they are the receptacles of excrements, as also because the Animall spirits did not stand in neede of any sensible cavity. But *Galen* answereth, that Nature hath prepared them to serue both turnes; like as through the spongie bone odours doe ascend and surperfluities or excrements descend. As therefore those things which are auoyded euery day by the pallat and the nostrils do neither hinder the Taste nor the Smell if they be moderate: so it is in the excrements of the braine.

QUEST. XIII.

Which of the ventricles are most excellent.

Of the prehe-
minence of
the ventricles
of the braine.The vpper
ventricles are
the basest.The 4. the no-
blest.

CONCERNING the excellency or *superiority* of the ventricles of the braine some different places in *Galen* are to be reconciled. It is commonly receiued that among the parts of the Braine the ventricles are most excellent, not because they are particular seates of the Principall faculties, but because in them the Animall spirits are generated. That teacheth *Galen* in the third Chapter of his 7. Booke *de Placitis Hippoc. & Platon.* If saith he, you cut the braine any way the creature will not loose sense and motion before the wound pierce vnto some of the ventricle. But whereas there are foure ventricles it may be demanded which of them is most noble.

Galen teacheth that the vpper ventricles are the basest; In his 8. Booke *de vssu partium* and the 10. Chapter: in his 7. *de placitis*; and in his Commentary vpon the 18. Aphorisme of the seuenth Section, by the example of a young man of *Smyrna* a City of *Ionia*, who being wounded into one of the vpper ventricles yet escaped with life. Concerning the third and fourth ventricles *Galen* seemeth to differ from himselfe; for in the fift Chapter of his third Booke *de locis affectis* he yeeldeth the prerogative to the fourth ventricle. The Animall spirit

spirit, sayth he, is containd in the ventricles of the braine, especially in the hindermost, although the middlemost is not to bee contemned: which is as much as if hee had sayed the middlemost is not the noblest. For wee are perswaded by many reasons to esteeme this above the two vpper. In the third Chapter of his 7. Book *de placitis*; A wound in the hindermost ventricle doth most of all offend the Creature; In the second place the wound of the middle ventricle; but least of all if it be in the two vpper: the same thing may bee sayed of sections or bruises of the head. And these authorities of *Galen* are seconded by reason; for it is a perpetuall truth in the body of a man, that by how much the cavity is greater, by so much it is the baser. The fourth ventricle is of all the rest the least and the narrowest, and containeth the Animall spirit sincere defœcated and exquisitely purged: the other do onely prepare the spirit, and therefore the hindermost ventricle is the most noble.

According to
Galen.

Yet *Galen* in many places seemeth to say the contrary, as for instance in the 7. Chapter of his third Booke *de locis affectis*, and in the second Chapter of his fourth Booke, hee preferreth the third ventricle. If, saith he, at any time the whole fore-part of the braine be affected, those things which concerne the vpper ventricle are drawne into consent, and the action of discourse is vitiated; where, by the vpper ventricle he vnderstandeth the third or the middle: but why, I am not able to giue a reason. But if discourse be seated in the middle ventricle, then is it the most noble. In the last chapter of his third Booke *de placitis* expounding the fable which faineth Minerua to be borne out of the toppe of *Iupiters* head: Therefore, sayth he, they faigne her to be borne out of the top, because thereunder is seated the middle ventricle which is the principall of the braine and the originall of wise dome.

Galen seemeth
to say the con-
trary.

Mereouer the wonderfull structure of the third ventricle is an euident argument of the excellency thereof, as also because the wounds of the *Occipitum* are lesse dangerous then those of the *Sinciput* or fore-part of the head. So saith *Hippocrates* in his Booke *de vulneribus capitis*. More escape death that are wounded in the hinder parts of their heads then in the fore-part.

The reason.

You shall reconcile *Galen* if you say, that when he auoucheth the fourth ventricle to bee the most noble, then he speaketh according to his owne iudgement: but when hee preferreth the third he speaketh according to the opinion of other men, especially of *Herophylus*. For *Galen* did not attribute or assigne to the principall faculties particular mansions or habitations in the braine as we haue heeretofore prooued.

Galen recon-
ciled.

Againe, vpon a wound in the *Occipitum* or nowle of the head, the fourth ventricle is sildome offended, because there is much flesh and the thicknesse and hardnesse of the bone to resist the violence of the blow, whereas the bones of the *Sinciput* or fore-part are much more slender and weake.

In the whole history of the head I do not finde that *Galen* seemeth so much to wander out of the way as in the description of the *Rete mirabile* or wonderfull Net, for this in a man is so small that a good eye can hardly discern it. I like rather, saith my Autor, to call the *Plexus Choroïdes* (which is manifest and obuius to euery eye in the vpper ventricles of the braine) *Rete mirabile* or the *Wonderfull Net*, as also some of the new Writers haue

The error of
Galen in the
wonderfull
Net.

done: for in it the vitall spirit is attenuated and the Animall getteth a certaine rudiment. And thus are we come to an end of the Controuersies concerning

the Braine especially the substance thereof. Now let vs proceed

to the second part of the head which is called

the Face and so to the

Senses.

The end of the Seauenth Book and the Controuersies thereunto belonging.



THE EIGHTH BOOKE.
Of the Senses and their Instruments,
as also of the Voyce.

The Preface.



Although in the former Booke we have made mention of the Instruments of the Senses when we described the Coniugations of the Sinnewes of the Braine, yet because there are many other parts in the Head set apart for their vse, wherein the glorious wisdom of our Creator dooth most manifestly shine and in the preservation whereof we are deeply interested, I haue thought good to appropriate this Eight Book vnto the History of the Senses. Now in euery Sense there is a Matter and a Forme. The Forme is the Faculty which is yssuing from the Soule and differing in Name not in Nature as it informeth this or that Matter which is the Instrument. The first of the Senses is the Eye the most precious part of the body; and they are two, that if one should miscarry the other might supply the necessity of Nature. They are set like Centinels or Scout-watches in the top of the Towre, whence they may discern the farther off if any thing approach either hurtfull or behoouefull that we may apply our selues to it or auoyde it.

The eyes,

Galen is of opinion that the Head was placed vppermost in the bodie for the Eyes sake, because the Opticke Nerves stood in neede to be very short. For their security they are scituated in Caues and defenced about with diuers Muniments. Above them hangs a round arched brow to beare off and cast ouer what might fall from the Head, and betwixt them runnes the Nose as a strong wall, vnder them the bones of the Cheeke stand out, and at their side the hard bones of the Temples.

They are immediately couered with soft lids that nothing might impeach the delicacy of the instrument; the vppermost are moouable and very nimble which do shut vp the pupils as well in rest to refresh them, as also when any outward iniury is ready to annoie them; the lowermost are immoouable or at least mooued insensibly. These liddes are againe bearded with haire whereby and wherein small bodies or Motes which happly in their approach are not discerned might be intercepted.

The Eyes themselves haue many Muscles allowed them whereby they are mooued euery way, vpward and downward, to the right and to the lefte and round: they are also by a Muscle sustained and kept stable or firmed whereby the sense is more certaine. Diuers Coats they haue wherewith they are couered, the first called *Adnata*, the second *Cornea*, the third *Vnea*, the fourth *Aranea*. There are also three Humors, the first *Watery*, the second *Glassy* and the third *Christalline* which is the chiefe Organe of the sight, and is assisted by the other parts aboue mentioned. The eye indeede seeth with the *Christalline* humor, but it seeth perfectly and more accomplishedly with the whole Organe or Instrument. The object of this sense are those colours which are in the superficies of other bodies.

The Eares.

Next followeth the Eare, the Instrument whereby the Soule discerneth of all manner of sounds and voyces. The chiefe part of this Organe is a thin and subtle ayre bredde in the eare and seated within the cauity thereof; to which aire the ends of the Nerves of hearing which come from the Braine doe attaine: and as the Opticke Nerue encompasseth the *Christalline* humour, so this nerue of Hearing is thought to encompassse the *In-bred Ayre* and

and spirit, and so the society growes betweene the instrument of the Sense and the inward principle of Sensation. Before this Ayre is a Membrane stretched which we call the *Drum* supported and established with three Bones, the smallest of the whole body, but none formed with more curious Art; the first is called the *Hammer*, the second the *Anvill*, the third the *Stirrop*. Many men haue laboured to assigne to each of these their proper vses and how they conferre to the sense of Hearing, but truth to say, their discourses do rather fill then feede the minds of their Reader.

God hath reserued many secrets in mans body to himselfe, whereof wee iustly thinke this is one; yet we know that they sustaine the Membrane of the Tympane against which the representation of the sound or voice is beaten and communicated to the inbred Ayre. These sounds are admitted to the Instrument by the hole of hearing, a hard & dry entrance full of embowed Meanders and Convolutions, lest the outward aer falling or rushing suddenly vpon the *Drum* should endanger the breaking thereof. Without the Eare there standeth a gristly substance which partly defendeth the hole of Hearing that nothing fall into it, partly catcheth and staith the sound that it passe not by.

The third Sense is that of Smelling, whose Instrument doth not yssue out of the Scull in those Creatures which do respire, but is conteyned within the substance of the Braine: whence it followeth that these 5. are called outward senses, not because they appeare outwardly, but rather because their proper organs doe receiue the species or representations of outward things. The instrument therefore of smelling is a paire of productions issuing out of the forward Ventricles of the Braine, in which the faculty of smelling residing doeth comprehend the odors of things which together with the aer are drawne in thorough the passages of the nose, which is rayed higher in the face of a man then of other creatures, as well for beauty, as because the Braine of a man being large and therefore yeelding abundance of excrements might there-through bee better clenfed. This nose is diuided in the midst by a gristly substance, aswell to breake and diuide the outward ayre which in a great part is drawne in this way to be conueyed into the sharp arteries and so to the lungs; as also to disperse the parts of the object of this sense, that being so diuided it might equally insinuate it selfe through the smal holes of the spongy bone to both the productions which determine on either side.

The Nose.

The fourth Sense is the Taste, the Forme wherof is seated in those Nerues which attaine vnto the tongue and pallat assisted by the spongy flesh of the tongue it selfe. For when any sauour quality or affection imparted to a humor or iuice is applyed vnto the tongue; it stirreth vp the taste, and presently the image or species of that sauour is by the spirit residing in the Nerues conueyed to the principall Sensator; and if it happen that the sauour be represented to the instrument in a hard or congealed body as salt, pepper or such like, it cannot moue the sense before it be melted by the heate, or at least haue communicated his affection vnto the moisture of the mouth, and therefore it is that nothing can affect the taste which cannot be dissolued, neither is he whose tongue is torrifed or parched with extraordinary heate a competent iudge of sauers or Tasts.

The Tongue.

As for the Touch which is the fift and last sense; it is not contained within any proper organ or instrument but equally diffused through the whole body, because the necessity of Nature did euery where require the presence thereof for the security of the life of the creature; and yet notwithstanding it dooth not (as other senses) receiue the impresson of all his owne proper objects. For sensation is a passion: if therefore the Object be of the same temper with the Instrument, the sense is not affected therewith, because it doth not suffer by that which is like vnto it; but all the other senses do apprehend all those qualities which do fall vnder them; for being all vnlike to the instruments they must needs be affected by them. But because this sense hath no particular instrument in the head, we shall onely intreate of it by the way in this place; somewhat we haue spoken of it before in our discourse of the skin, and more we shall haue occasion to say in the booke of the Ioynts and the Vessels. Wherefore we descend vnto our History.

The sense of Touching.

CHAP. I.

Of the other part of the head which is called the Face, together with the vessels and muscles thereof.

The Names
of the face.

 Auing gone through that part of the Head which is covered with a hairy scalfe and therefore by Aristotle in the 7. Chap. of his 1. Book *de Historia Animalium* called *πρὸς ὀφθαλμὸν*; it remaineth that we proceed vnto the other part which is without hayre called in a map *πρόσωπον*; which name it seemeth to haue receiued from the thing it selfe, saith the Philosopher in the 1. Chap. of his third Book *de partibus Animalium*, because a man *πρόσωπον* "οὐρα", that is, looketh forward; for of al creatures only man goeth vpright and looketh directly forward. The Latines call it *Facies*, in the comely conformation and Beauty whereof the elegancy of the humane nature doth most appeare. It is also called *Vultus à voluntatis indicio*, because it bewraith the disposition of the will, and is especially changed according to the variety thereof. We call it the Face or the countenance.

The parts of
the face.

The parts therefore of the Face are two: the vpper is properly called *μετωπὸν* *Frons*, à *ferendo*, because it beareth in it the Passions of the minde, we call it the Forehead whose lowest parts are the eye brows. The second and lower part of the Face beginneth at the eye-brows and reacheth to the bottome of the Chinne, in which there are many parts. Both these parts of the face haue also some parts conteyning and some conteyned. The containing parts are common or proper: common as the cuticle or scarfe-skinne and the skinne it selfe; which in this face, in the fingers ends, in the Yarde and the Cod is most thin. This skin in the Cheekes for the most part looketh red because of the affluence of blood from the ytter branch of the externall Iugular veine; which is disseminated betwixt it and the fleshy membrane. This skin is furnished with hayres; about the eyes for their security; about the mouth in men as an argument of their virility and a peculiar beauty of that sexe; for in a woman those hayres are an especial deformity. Hence also (saith Galen in the 14. Chap. of his 11. Book *de usu part.*) a man becommeth more venerable, especially if when he be growne to a ripe age the haire also do plentifully compasse his mouth on euery side, for which cause also nature hath left the Cheekes and the Nose bare and without haire.

The skinne.

The hayres.

The perfora-
tions of the
face.
Their vse.

This skin of the face is diuersly perforated for the eyes, the eares, the nostrils and the mouth; partly that the sensible objects might haue the freer access; partly to intromit aire and nourishment, and to auoide excrements. And these perforations if their actions be alwayes required are alwayes open. As the nostrils for respiration, the eares for hearing because these two were alwaies necessary. As for those whose functions were not so indefinent, especially in the time of sleepe and for the auoyding imminent dangers, those perforations I say, for more security may be shut as the eyes and the mouth.

The fat.
The fleshy
membrane.

The fat of the face is very little and that that is, is about the Cheekes.

The vessels
and the glands.

The fleshy membrane which in the rest of the body is almost wholly neruous, in the forehead is fleshy and musculous; so close ioyned to the skinne that it can hardly bee separated therefrom. And it is red because of the muscles of the face which grow vnto it. Betwixt this fleshy membrane and the skin the veines before spoken of do runne, where also are many glandules dispersed, as vnder the rootes of the eares in which the disease is bred that wee call *Parotia*, as also betwixt the lower Iaw and the inferior part of the Cheekes where those Tumors arise which we call *Scrophule* or the Kings euill.

The proper
contayning
parts.

The proper containing parts are muscles, bones and gristles which make the frame of the face it selfe. The muscles are, of the forehead, of the eye-brows, of the eye-lids, of the nose-thrills, sometimes also of the eares, of the lips, of the lower Iaw, and of the Cheekes. The bones are, the forehead-bone, the 6. bones of the eyes, three of the Nose, 6. of the mouth, that is to say, two of the vpper Iaw, and two of the nether Iaw, and as many of the Palate. The Gristles are, of the eares and the nose which are diuersly ioyned with the bones.

The parts
contained.

The parts contained in the face are the seates of the foure senses; whose organs either it containeth as it doth those which haue no place within the skull, or else it prepareth a way for them that lye hid within the Scul.

These Organes of the senses are the Eyes, the Eares, the Nose, and the Mouth, wherein are contained the Tongue and the Throttle which are the instruments of the taste and the voyce. And indeede because the Organes of the senses are placed in the face, it is truly called

called the Image of the minde, for as *Laurentius* saith truely, in the eye-browes dwells pride, in the Cheekes shamefastnesse, in the Chinne maiesty, in the Forehead wisdom, finally, in the whole countenance beauty and honesty. But to speake more like a Physitian, in the Face doe appeare the manifest signes of life and death, and therefore *Hippocrates* in his Prognostiques commands the Physitian first of all to take view of the sickmans face, whether his countenance be like that it was in his health, or whether it bee much changed in colour, figure and magnitude.

How the
mind shineth
in the Face.

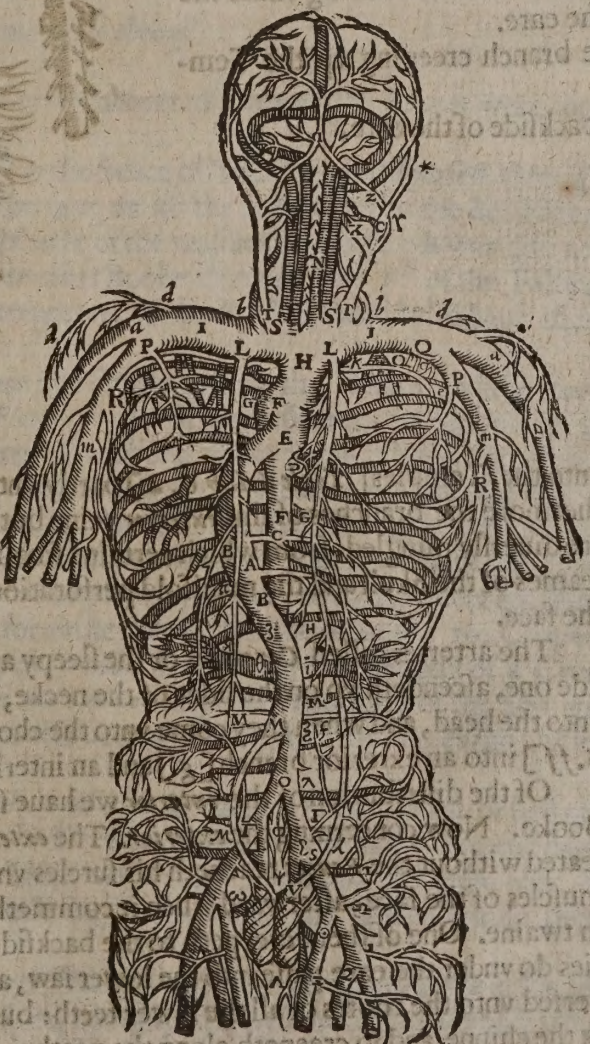
But before we come to the particular handling of the Organes of the Senses, it shall not be amisse to giue you in this place a light view of the Vessels of the Face and of the Muscles which mooue the skin of the Head. The Vessels therefore which are deriued through the face are Veines and Arteries. The Veines are called Iugulars, whereof one is internall, [Tab. 6. lib. 6. S S] of whose distribution we haue spoken in the eight chapter of the precedent Booke. Another externall [Tab. 6. lib. 6. T T] which ariseth out of the vpper part of the *Subclavian* branch, and ascendeth on the sides of the necke vnder the chin, yeelding furcles to all the outward parts of the Necke, the Head and the Face on his owne side. But for the most part vnder the roote of the eare, [Table 6. Lib. 6. V] it is diuided into an vtter branch [y] and an inner. [x] The inner branch reacheth vnto the muscles of the mouth, the chops and the bone *Hyois* as before is saide. The vtter creeping along the skin and the Muscles and skin of the head, beeing vnder the eare supported with Glandules, is parted into two branches, whereof one bending vnto the foreside of the face [Tab. 6. lib. 6. Z] attaineth vnto the Nose and the Cheekes, and in the middle of the forehead is ioyned with a branch of the other side, and maketh the fore-head Veine which in some cases wee vse to open, [Table 6. lib. 6. a] The other branch passeth by the side and sprinkleth his branches partlie

Prediction by
the Face.

The vessels
of the same.
The Veines.

Table 6. sheweth the trunkes and branches of the hollow veine as they are disseminated through all the Regions of the body.

TABVLA VI. Lib. VI.



Q. The double Scapulary, or the veines of the shoulder-blade.

RR, The Lower Chest-veine.

SS, The internal Iugular Veine.

TT, The external Iugular Veines.

V, The external Iugular Veine diuided into two vnder the roote of the eare.

X, The inner branch thereof.

Y, The outer branch thereof.

Z, A branch proceeding from the vtter Veine next aboue named, to the Face.

a, The forehead Veine.

• A branch creeping vp the Temples.

• A furcle reaching to the Nowle or backside of the head.

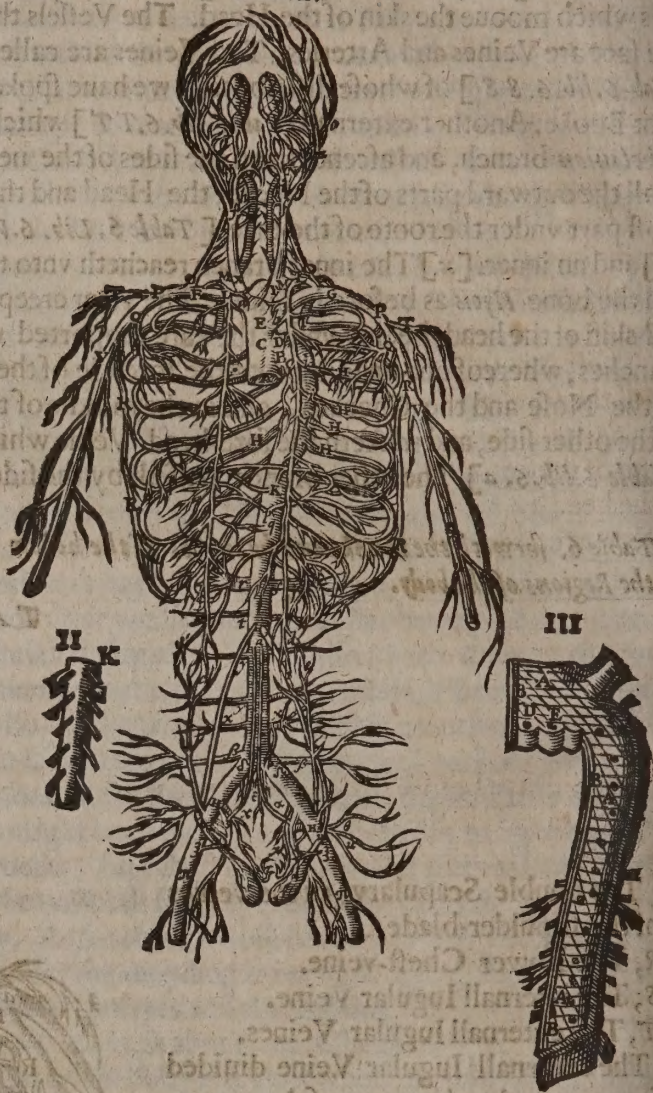
Table 13. Fig. 1. sheweth the trunk of the great Artery, together with his branches as they are disseminated through the three bellies or Regions of the body.

The second Figure sheweth a portion of the Artery as it is on the backside, from whence it sendeth branches to the distances betwixt the lower ribbes.

The third Figure sheweth a portion of the great artery; where it yssueth out of the heart shewed open: and by that meanes we may better perceine his Coates and Fibres.

TABVLA XIII.

FIG. 1.



- TT, The Artery called *Humeraria*.
 VV, The remainder of the *Axillarie* Artery reaching to the armes.
 XX, The right and left *Carotis* or the sleepy Arteries.
 ee, The coniunction of the *Mammary* with the *Epigastricke* Arteries.
 ff, The diuision of the sleepy Arteries at the chops.
 g, The externall branch.
 h, The internall branch which is deriued to the throttle, the chops and the tongue.
 i, This at the Basis of the Skull is distributed into two branches.
 l, The distribution of the branch g vnto the Cheeks and the Muscles of the face.
 m, The distribution of the branch g vnder the roote of the eare.
 n, The same branch creeping vp the Temples.
 o, And the backside of the eare.

vnto the Temples [Table 6. Lib. 6. e] partly vnto the *occiput* or Nowle of the head. Furthermore the branches of this exterior veine both in the face and in the crowne of the head are diuersly mingled, from which certaine small threddy strings are distributed into the seames of the Skull and the manifold perforations thereof. And so much for the veines of the face.

The arteries
of the face.

The arteries called *Carotides* or the sleepy arteries [table 13. Lib. 6. XX] being on each side one, ascendeth vp on the sides of the necke, together with the *Iugular* veines, directly vnto the head, and when they come vnto the chops or Fauces they are deuided [tab. 13. lib. 6. ff] into an exterior branch [g] and an interior [h].

Of the distribution of the interior we haue spoken in the eight Chapter of the former Booke. Now concerning the exterior. The exterior which is lesse then the interior and is seated without the Fauces reacheth his surcles vnto the cheeks [Table 13. Lib. 6. l] and the muscles of the face; afterward when it commeth to the roote of the eares [m] it is parted in twaine. One of them creepeth to the backside of the eares at [o] from which two arteries do vnder the eare passe into the lower iaw, and according to the length thereof are dispersed vnto the rootes of all the lower teeth: but another part yssueth at the hole which is in the chinne, and so creepeth along the neather lip. The other artery of the by-partition at

[p]

[E] creepeth vp the temples and the forehead and is consumed in the muscles of the Face. And so much of the vessels.

The Skin of the head is in many men mouable, but of the forehead in all men; not onely by the benefite of the fleshy membrane, which degenerateth into a musculous substance hauing right fibres, but also by the help of two muscles; assured so to be, both by the course of their fibres, as also by their motions which appeare in these after the manner of other muscles and not like the motion of the fleshy membrane. These are scituated in the forehead [Table 6, Figure 1. A] and doe arise aboue where the hayre determines; sometimes as high as the crowny seame neare the Temporall muscles; the right at the right and the left at the left Temple, (where the fleshy membrane cleaueth so close to the *Pericranium* or skul-skinne and the Skull it selfe, that it is altogether immouable: so that the forehead and the Eye-browes are mooued when the membrane is at rest) and toward the common seame which distinguisheth the bones of the head from those of the vpper iaw, are implanted with right fibres aboue the eyes and the nose into the skinne at the browes as at the parts which are to be moued.

The muscles of the forehead.

I sayd these fibres were right and not oblique as some haue thought: and here Chyrurgions must obserue that in opening Apostemations in that place they make not their incisions ouerthwart as the wrinkles of the skinne doe goe, but according to the right fibres.

A good note for Chyrurgions.

These two muscles are a little disioyned in the middest, and that is the reason why the top of the forehead is not moued. Vpon this coniunction some haue thought them to bee but one muscle. Against whome we shall further dispute in the proper place where we treat of these in our booke of muscles. There are also other muscles which draw the skinne of the head backward, but those belong not to this place.

Why the top of the forehead is not moued.

Now we proceed vnto the Organs of the Sences.

CHAP. II.

Of the Eye and parts thereof.

As I sayd before that the habitations or residences of foure of the Sences were contained in the face.

The fift externall Sence, which is the Sence of Touching is dispersed through the whole body and hath no proper seat in the face, as all the rest haue. For the head being the seat of the Animall faculties and the habitacle of the reasonable Soule; it was also necessary that the Sences (which as *Hippocrates* in his Booke *de morbo sacro* or of the Falling sicknesse, sayth, are the messengers and interpreters of the Soule) should also haue their residence in the head.

These outward Sences are fise as there are fise simple bodies, the Heauen and the foure Elements. Wherefore according to the *Platonists*, the Sight answereth in proportion to the Element of *Starres* whose obiect is shining. The obiect of the Smell is fiery, and therefore it is sayd that *fragrantia* are *flagrantia*. The obiect of the Hearing is ayrie: the obiect of the Taste is watery, and of the Touch earthy. But amongst these the sight is the principall, which with hearing makes a mannes life much more happy, albeit without the Taste no man can be so well nourished. For those who eyther by Nature or by Accident are blind do account themselues therein miserable; for as the Sunne (saith *Galen* in the 10. Chapter of his third Booke *de vsu partium*) in the great world, so is the Eye in the body of a Creature; and therefore *Hesychius* calleth them *ἡλίου πύλαι* *Solis porta*, The dores of the Sun; and therefore we will first intreat of the Eyes, as also because amongst all the nerues the Optick nerues haue the first place.

Why 5. sences
How the sences
answer the elements.

Galen:

Hesychius:

The Grecians call the Eye *ὀφθαλμός* *quasi* ὁ πόνος *δράματος*, because it is the couch or bed out of which the Sight shineth. And therefore the Eyes are called by others *παύλα*, because from thence that is the light proceedeth. The Latins as *Varro* and *Lactantius* call them *oculi*, *ab oculando vel occultando* from hiding, because they are couered and hidden within their Liddes.

The names of the Eyes.

These Eyes are the Organs of the faculty of Seeing, which we vse (sayth *Galen* in the fift Chapter of his 8. Booke *de vsu partium*) as spies, not only to auoyd those things which wold of.

Their excellency.

offend vs, and to leade vs vnto that which is profitable, which vse is common to vs with brute beasts, but especially that by those things which are visible we may take consideration of the omnipotency of the inuisible God. Hence it is that *Plato* saide well, that if wee wanted our Eyes we should be ignorant of that excellent order which Nature hath established in the frame of the world and of our owne bodies. *Aristotle* addeth that the Science or exquisite knowledge of all things is exceeding much furthered by the eyes. And therefore *Galen* calleth them diuine members: Seeing therefore their necessity is so great it is no wonder that God the Creator made them after so excellent a manner as it were a curious modell to manifest his Maiefty and wisdom.

Their situation.

They are scituated in the head as in the highest and best defended place of the body, immediately vnder the forehead as Scoutwatches: for as watchmen are placed in high standings and turrets that they may further off discern whether any enemies be approaching or ly in ambush, so the eyes are set aloft to foresee and giue warning of any danger that may be toward vs. *Galen* and *Auicenna* haue conceived that the head was especially made for the vse of the eyes, their reason is, because the opticke nerues being very soft, could not safely be placed farre from them. They are seated in the forepart of the head, whereof *Galen* in the first Chapter of his tenth Booke *de vsu partium* rendreth a reason, because (saith he) the Instruments of this sense do require soft nerues which could not be produced from the *Cerebellum* or After-braine as being much harder then the braine it selfe.

The reason thereof.

Moreouer being placed before, they are directly opposed to their objects, and we moue forward, neyther can we discern cyther on the side, or behind vs, vnlesse wee turne our heads about. They are seated within bony cauities which *Pollux* calleth *οφθαλμοι* or Orbes, & that for security; haply also because the spirits might be lesse dissipated.

Their number

They are in number two, (as also are the other instruments of the senses) mooued together and at once with the same motion, that the sight might be more perfect; for if one of them had beene lifted vp and the other depressed, then euery object howsoeuer would haue appeared double: for it was necessary that the axes or diameters, that is, the imaginary lines of the pointed objects should determine in one and the same place: and this ioynt action of the eyes is assisted by the coniunction of the mouing sinewes in their originall as we haue already declared. Obserue further with *Aristotle* in the 17. Probleme of the 10. Section. That amongst all Creatures a mans eyes stand neereft together for his proportion.

Their figure.

Their figure in a man is round and sphericall [Table 2, Figure 3, and 4] but in other creatures they are not perfectly round, but eyther oblique or depressed, [Table 2. fig. 5.] and no maruell seeing the whole figure and fashion of a mans body differs so much from other creatures. But if you consider them together with their muscles which grow to their back-sides, then is their figure turbinated like a sugar-loafe. [Tab. 1. fig. 4, and 9] The reason why they were made round, was partly that they might be more capacious because they were to containe many parts of great vse. Againe, that figure is the strongest and lesse subiect to offence by outward iniuries. Finally, their roundnes makes their motion more nimble, to which end also they are smooth and slippery that we might command our sight euery way at our pleasure and vpon the suddaine. Wherefore the Maisters of the Opticks say that because of the orbicular or round figure of the eye, the beames from which side soeuer they come are broken at the Perpendicular, that is to say, they arriue directly in the center of the eye. Their magnitude is proportionable to the magnitude of the body and their owne vse. And heere we are to consider two kindes of parts; the one of those which are disposed about the eyes for their defence: the other, whereof the eye is compounded.

Their magnitude.

For defence Nature hath compassed them with bones which frame their Orbe, and beside these they are walled, aboue with eye browes, before with lids, and in eyther place fenced with hayres and the skin. For first of all the brim of the eye-lids stand as a wall of defence with their hayres shot out that no small mores or other annoyances might fall into the eyes when they are open. Then the lids themselues, that closing together they might shut vp the eye if any greater body or more violent offence should bee offered thereunto. Furthermore, to defend them from violence, aboue they are secured by the eyebrowses, below by the Cheekes, at the great angle with the Nose, at the lesser by the production of the yoke bone, and so if any greater body do rush against the eye, it is receiued by one of these, the eye which is in the middest remaineth vnoffended. The motion also of the skin as well that of the forehead as also that of the Cheekes is a great security vnto the eye, for the skin being contract the eye is as it were drawne inward, and the same againe extended openeth them

How they are defended.

Their parts.

them wide. The orbe of the eye is round, [table 2, lib. 7. fig. 6, at Q. tab. 12. fig. 8, betwixt X and R] that therein the eye might be better rowled: long, because of the muscles whereby the eye is mooued, and compassed with a *Periostium* or thin membrane. It is formed of the bones of the head and of the vpper iaw. But *Aquapendens* addeth also the spongy bone which we call *Ethmoides*. The bones of the head which make the orbe of the Eye, are the forehead bone and the wedge-bone, whence it is that in these dennes of the Eyes there be many sutures and holes to be found. The forehead bone whose outward seat or table is smooth, maketh the vpper Arch of this rooffe: and where the tables are ioyned againe, there in the place of the Eye-browes it buncheth outward [tab. 3. lib. 7. fig. 8. ARX] and so defendeth the Eye. The wedge-bone is in the backe part of the hollownesse or cavity of the orbe, where it is perforated with foure holes. [tab. 3. lib. 7. fig. 8. neare DG] The bones of the vpper iaw which help to make the orbe of the Eye are: the first which maketh his outward eminence below. [tab. 3. lib. 7. fig. 8. r] The second and the third [tab. 3. lib. 7. fig. 8. ΔΘ] are in the inside, very thin bones, because the protuberation or swelling of the nose is also a defence in that place. The fourth bone of the vpper iaw lendeth a part to the framing of this orb where the cheekes rise vp into a swelling prominence. [tab. 3. lib. 7. fig. 8. neare i.]

The bones of it.

The sutures or seames in the bones of the iaw are three; one at each angle or corner, the third in the lower side of the orbe: the sutures of the spongie bone are two, both at the great angle. Finally, there are other sutures betwixt the wedge-bone and the forehead-bone. And vpon these sutures are the *Pericranium*, the lower oblique muscle and the pully suspended.

The Sutures of it.

The holes in the orbe are three and those very large; one in the hindmost part which is round, made for the transmission of the opticke nerue, the second is in the lower part of the cavity of the orbe, and is a long rift through which the nerue which mooueth the eye together with some veines and arteries are deriued vnto the Eyes and their muscles. The third is at the inward angle and perforated into the bones of the nose, through which holes sometimes a part of the teares do yssue,

The holes 3.

In these orbs of the Eye doe arise on either side two *Sinus* or circles, which *Aristotle* in his first Booke *de Historia Animalium*, calleth common parts of the vpper and neather Eye-lid, because they are made of both the Liddes extended out in length. These circles the Grecians call *nasol d'ro rē n'nd'ed'ra*, that is, from a Sence of Itching, because in them oftentimes by reason of the teares or of some other humour we finde a notable itching.

The angles or corners,

The Latines call them *anguli oculorum*, we the corners of the Eyes, wherein the teares and whatsoeuer yssueth from the Eyes is gathered together. The outward angle or corner toward the Temples is called *Canthus minor* or *externus*. The other inward to the nose *Canthus maior* & *internus*. [table 1. figure 1, and 6. e sheweth the greater corner and d the lesse] *Pollux* calleth the greater angle *παρὰ τὴν ὕδρα* the waterer, and *Hesychius* *πηγὴ* or the fountaine, because from thence the teares doe yssue.

Their names.

But these names I take to be fitter for the orbe it selfe then for the corner of the Eye, for in each angle in the very extremities or ends of the ridge of the eye-lid both aboue and below there are two holes [tab. 1. fig. 4, 7, 8. m n] which in the lesser corner can hardly be perceiued when a man is aliue, but after death they are not at al conspicuous: but in the inward and greater angle these holes are larger and easie to be perceiued if wee marke them well especially in women; whence haply it is that they haue teares at command. But in the eye of an Oxe euen after he is dead they may easily be demonstrated [tab. 1. fig. 4. m n, fig. 7, and 8, they are onely expressed in the greater corner at n.]

The holes of the eyes,

Why woemen haue teares at command:

These holes are called by *Fallopins* in his obseruations *Puncta Lachrymalia*, as also by *Platerus*, because thorough them the teares doe distill, especially by the greater, which nature vseth rather and oftner then the lesse, because the scite thereof is more declining. Although there is a more open way for them through the nose, the bones of the vpper iaw being notably perforated in the top of the nose, which holes haue certaine passages, which vnder the caruncle are vnited into a common bosome ending in the cavity of the nose, and this cavity is properly called *πηγὴ* that is, the fountaine.

Puncta Lachrymalia.

But this Bone because it is of it selfe thin and hollowed, beside by the passage or canale before spoken of is sometime exulcerated by the Acrimony either of other humours or of the teares; which sayth the Philosopher in the 35. Probleme of the fift Section, are like vnto sweate: and this kinde of Vlcer is called *Fistula Lachrymalis*, wherein if you presse the inner corner of the eye, you shall find a *Sanius* or mattery substance to yssue.

The disease called *Fistula Lachrymalis.*

This

The wisdom
of Nature.

A Caution
for Oculists.

Divers opini-
ons concern-
ing teares.
Aquapendens
opinion.

Banbina's opi-
nion.

wounds of the
face are moist:
why.

The matter of
the teares.

The great ca-
pacity of the
orb of the eye.

The inconue-
nience of the
moisture de-
tained:

This matter is also oftentimes thinner, of which *Hippocrates* speaketh in his Booke *De Præca Medicina* where he saith, that oftentimes there is a Flux of humors even to the eye whose acrimony exulcerateth the eye-lids, & the parts vnder them it gnaweth asunder, yea sometimes it eateth thorough the coate that compasseth the Apple of the eye. That therefore this exulceration might be prevented, Nature hath set at the inner angle a Caruncle or glandulous flesh which the Grecians call *ὀφθαλμὶς* or *ἐπιμάστιξ*, although *Agineta* giueth it that name onely when it is growne about the due proportion. *Galen* eleventh Chapter of his tenth Booke *de usu partium*, calleth it *σῶμα σαρκώδες*, *Corpus Carneum*, The fleshy body. [Tab. 1, Figure 7, 8. r] This Caruncle was made to defend the bone from the sharpenesse of the humors. Moreouer, it serueth for a couering whereby the perforations which wee saide before were made through the bone, are as it were stopped with a sponge, through which the excrements of the eye may soke into the nose, but cannot returne againe to offend the face, or to make vs alwayes weepe. Wherefore, those whom we call Oculists, that is, such as professe and intend the cure of the eyes; must take heed that they do not vse such sharpe Medicines as may colliquate or dissolue this Caruncle. For wee haue often seene that Medicines applied to the eyes haue through these holes past into the nose, and so haue beene cast out either by emunction or by the mouth. But because wee are come to make mention of teares, it shall not be amisse a little to stand vpon the nature and manner of the auoyding of them.

Plato, *Aristotle*, and *Theophrastus* do thinke the teares are a kinde of sweate, or at least much like thereto. *Aquapendens* his conceite how agreeable it is to reason let others iudge, sure it is very quaint and witty, his words are these. The Tears are an excrement of the third concoction in the eye, proceeding from the nourishment of the Glassye and Cristaline humours; which excrement is engendred of blood as of his proper matter, yet is that blood diuersly altered by the temper of the eye. For from these humours of the eyes there is a double excrement separated; one thicke, another thinne. The thicke excrement is that blacke slime which cleaueth to the Coats called *Vnea* and *Choroides*. Another thinne which are the teares to which a whayie or serous humidity may be added. Thus far *Aquapendens*.

But *Banbina* is of opinion that these teares are the excrements of the Braine, whome happily it will be more safe to follow. Now whereas in euery concoction there is a double excrement separated; one thin another thicke. In this concoction which is celebrated in the Braine, the thicker excrement which is viscid and crasse Flegme is spit out of the mouth from the pallate or else descendeth by the nose. The thinner excrement is partly euaporated insensibly, partly it commeth away very manifestly, and sometimes mixed also with a more crasse excrement: now it moyleneth the tongue and the mouth to make the speech freer, and to helpe mastication or chawing of the meate. Sometimes it is transported to the whole face, but especially to the cheekes, to the temples and the eares; which may bee prooued by wounds inflicted vpon those places, which though they seeme to be healed, do yet notwithstanding for two or three months together euery day yeeld a great quantity of pure and waterish humour, issuing by the hole that is left in the wound, which no art is able to consolidate or make vp, which obseruation we confesse we haue from that notable Anatomist and Chirurgion *Aquapendens*.

That moisture which is transmitted to the muscles is the matter of teares, to wit, that whay which together with the blood is transported vnto the braine to be *ὀφθαλμὶς τροφή*. The vehicle of the nourishment, that by the help thereof the blood might be able to passe through the small vessels which are dispersed through the substance of the braine, which whay beeing not fit for nourishment, in the nourishing of the brain is percolated through his thin substance, as the whay is separated from the milke. This moisture is gathered together in the bony orbe of the eye, which is indeed of so great capacity that the fourth part thereof is not filled by the muscles and nerues of the eye. It remaineth therefore after the manner of other excrements a conuenient time in that cavitie, and is sucked or drunke vp partly by the fat, partly by the Glandules which are of a rare and spongy substance. The reason why Nature detained these excrements in the orbe of the eye was to moisten the Muscles, which because of their continuall motion were not onely in danger to bee overheated, but also to be exiccated and dried vpp; vnlesse they had beene moistened and refrigerated by this matter of teares which swimmeth in a manner about the fat and Muscles of the eye. And this vse hath the moisture if it bee moderate, for if it be immoderate and de-

CHAP. 12.
Table 1. Fig.
banbina's
Fig. 1. (brow)
Fig. 2. and 3.
Fig. 3. (brow)
Fig. 4. and 5.
Fig. 6. and 7.
Fig. 8. The f
Fig. 9. The f

FIG. 1.

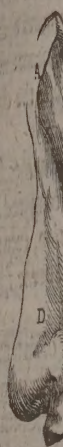


FIG. II.



Fig. 6. the moving
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hane deformed
named called *F*
Nature the
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or by the coldne
fir: at which tim
through thoch
of the eye-lids
tra of themelue

Table 1. Fig. 1. sheweth the whole eye, not at all dissected, his bones, together with the eye-lids and the hayres thereof.

Fig. 2. sheweth the eye-lid having the skin taken away.

Fig. 3, and 4. exhibiteth the muscles of the eye-lids.

Fig. 5. sheweth the eye-lids separated and inverted.

Fig. 6, and 7 sheweth the fig. of the whole eye with his muscles drawne out of the Scull and freed from the eye-lids.

Fig. 8. The fore side of the globe of the eye.

TABVLA I.

FIG. I.

FIG. III.

FIG. V.

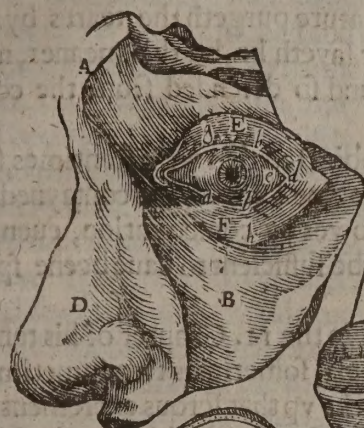
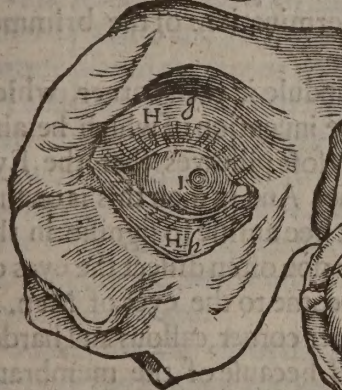


FIG. II.

FIG. IV.

FIG. VII.



- A 1, The forehead bone.
 B 2, The bone of the vpper Jaw.
 C 1, The yooke bone.
 D 1, The Nose.
 E 1, 3, The vpper eye-lid.
 F 1, 3, The lower eye-lid.
 a a 1, The Tarsus or little gristle wherein the haire grow.
 b b 1, The haire of the eye-lid.
 c 1, 6, The greater Canthus or corner of the eye.
 d 1, 6, The lesser Canthus or corner of the eye.
 e 1, 5, 6, 7, 8, The membrane called Adnate which in the 6, 7, and 8, fig. is intertexted or wouen with veines.
 f 7, 8, The Raine bow called Iris.
 g 1, 2, The hollownes of the vpper eye-lid and in the 7, and 8. the apple of the eye.
 h 1, 2, The vnder cavity in the lower eye-lid.
 m 4, 7, 8, Two holes in the greater angle or corner of the eye.
 o 7, The opticke nerue.
 p q 7, The Pia meninx at p and the thicke at q, which do inuest the opticke nerue.
 r 7, 8, A Caruncle or little flesh in the inter. or corner.
 G, The Cartilages or gristles of the eye-lids called Tarsi.
 H H 2, The orbicular or round muscle of the eye-lid without the skin.
 I 2, The hornie coate containing the Raine-bow and the apple of the eye.
 K 3, 4, The orbicular muscle of the eye-lid set alone, but in the 4. it is described compassing the whole eye-lid which Vesalins diuided into two.
 L 4, In this place Vesalins set the second.
 M 3, 4, The right muscle of the eye-lid set alone.
 N 5, The outward part of the eye-lid.
 O O O 5, the concavous and interior face of the eye-lid.
 P 6, the interior portion of the wedge-bone where-through the opticke nerue doth passe.
 Q Q 6, A part of the thicke membrane or Meninx.
 R 6, the concourse or meeting of the opticke nerues.
 S 6, the moving nerue of the eye. T 6, the fat betweene the muscles. U 6, 7, 8, A part of the coate called Aduata stretched vnder the eye-lids. X 6, Membranes going from the Scull-skin to the Tarsus or gristle of the eye-lids. Y 7, the muscles of the eye on the one side.

detained in the eye, it hindereth the motion of the muscles: wherefore Nature being heere-in very prouident and wise hath framed & prepared two wayes for the expurgation thereof. One by the corners of the eyes, another by perforations into the bones of the Nose as we saide euen now. For if the teares should perpetually drop out at the eyes they would haue deformed the face, as we perceiue by those who are troubled with the disease before named called *Fistula lachrymalis* or the dropping Fistule.

Nature therefore studdying to preferue the beautie and comelineffe of the face as also the cleerenesse of the sight hath provided meanes to moue them by expression or by dilatation and attraction. By expression the teares are mooued eyther when we rub our eyes, or by the coldnesse of the ayre, or by the winde, or by some grieve of minde and weeping fit; at which times they drop out like plentiful sweate, or rather like a bubling streame through those holes which we saide before were formed in the terminations of the brims of the eye-lids: for at such times the muscles of the face and of the adiacent parts doe contract themselues sometimes with waylyng and mourning, sometimes without; sometimes

The moving
of teares, how
many wayes.
By expression.

the Respiration being cut off in the middest with a sobbing stay and the voyce broken about the top of the *Larynx*, yea sometimes quite intercepted: and thus is this matter of the teares moued by Expression.

2. by dilatation
Hippocrates.

By dilatation they are drawne out sometimes by heat, often by laughter, sometimes by the Sunne, for sayth *Hippocrates* in his Booke *de videndi acie*, the Eye being not able to resist a bright object, calleth out the matter of the teares to succour it, which also in the conflict is heated. Anger also and a sharpe Ague doe by dilatation prouoke and call out the matter of the teares.

Aristotle.

And in such an Ague sayth *Hippocrates* in his first Booke *Epidemion* (if other signes be not mortall) teares so appearing doe foreshew a Fluxe of bloud by the nose. That these are the very causes of the profusion of Teares, we may gather out of *Aristotle* in the 13. Probleme of the fift Section. *Aquapendens* is of opinion that Nature purgeth the teares by an expulsive faculty giuen to the Eyes to auoyde offences; for sayeth he, by this meanes, not onely Nature is vnburnded but also the eyes are moystned and so defended from the contact of cold and heate.

Obiection.

But not to contend about this matter, it may further be obiected that we oftentimes see at once so great a quantity of teares as cannot possibly be imagined could bee containd in the orbe of the eye. I answere, that this serous humor followes by consequence, euen as phlegme doeth fall out of the braine. And thus much shall be sufficient to haue bene spoken of Teares and the manner of their euacuation.

Solution.

The glandules
of the eye.

At either angle of the Eyes (as also *Galen* hath obserued in the 11. Chapter of his tenth Booke *de usu partium*) are placed certaine glandules or kernels, sometimes two sometimes more; that with their rare and laxe substance they might sucke vp that serous excrement of the braine, by which the outward superficies of the Eye is moystned, and which (as we said) is the matter of the teares. And this moysture thus gathered in the glandules is at conuenient times euacuated by the corners of the Eye and by the terminations of the brimmes of the lids.

Fallopian.

Fallopian in his obseruations sayth, that there is but one Glandule in each corner, which is found in the vpper part of the Eye neare the vtter angle, the inuention of which he also attributeth to himselfe. Moreover these glandules do serue as soft pillowes that the Eye might not be offended in his motion at the hardnes of the bone. And in men this is on this manner: But in brute beasts it is otherwise; which it shall not bee amisse to signifie in the fauour of young beginners and Practitioners in Anatomy, who doe often dissect the eyes of Oxen and Sheepe to make them more perfect when they doe come to the eyes of Men.

Their vse.

The same in
an Oxe.

In an Oxe Eye therefore is found another glandule in the inner corner, callous and harder then that in a man, which should seeme to bee there scituated because of the membrane with which they wincke, which membrane is most like to that we cal the Naile of the eye, very thinne and like the horny coate, or something of the Nature of a gristle. This Naile or membrane of which *Aristotle* speaketh in the 12. Chap. of his second Book *de Historia Animalium*, is moued with voluntary motion to the outward angle and couereth the eye euen when the lids are open. For about the roote of this callous glandule there cleaueth a strong membrane, whose vse haply is, that while the Skin is drawne to the opposite angle, that glandulous body should be stretched or bent like the horne of a bow, and when the skinne is remitted, returne backe and draw it into his proper angle. And truly this membrane is drawne to the opposite angle by a double cord, the one is aboue, the other below lurking vnder the coate of the eye which we cal *Adnata*, and arising from a certain muscle scituated in the vtter angle, which muscle *Fallopian* accounteth to bee a part of that muscle which draweth the whole eye outward. And thus much concerning the parts of the orbe of the Eye.

A membrane
in the eye of
an Oxe.

CHAP. III.

Of the Eye-browes and Eye-lids.

The eye
browes.



He Eye-browes with *Aristotle* in the ninth Chapter of his first Booke *de Historia Animalium* we referre vnto the Eyes. They are called in Latine *Supercilia* because they be *super cilium*, that is, aboue the haire of the Eye-lids. *Hippocrates* in his Booke *de locis in homine*, as also the rest of the Grecians after him call them *opous*. They are,

are, sayth *Rufus*, hairy extremities of the forehead, or haire that grow about the eyes which are distinguished vnder the forehead on either side. These eye-browes are compounded of skin, fleshy fibres produced from the muscles of the forehead, fat and haire. The skinn is thicke and hard, thicke the better to defend the eyes, hard, that the haire might neyther be too many, grow into too great a length, for euen as saith *Galen* in a marriſh and weeping ground no grasse is brought forth neither yet in a squallid and hot soile, so when the skin is either too dry or too moyſte the haire cannot grow.

Whereof they are compounded. Aft comparison out of *Galen*.

These haire are called by the Physitians as *Pollux* witnesseth *τοιοῦτο*, and are bred with vs when we first come into the world, as also are the haire of the eye-lids, whence it was that the Egyptian Priests who vsed to shau all their haire did notwithstanding suffer these to grow. And although these haire are of an equall length, number and thicknes, yet are they not right but grow crooked and oblique, bowing after the roundnes of the eye, that they might the better avert and turne aside whatsoever shall fall toward it. If they had bin too short, too few, or too thin, they would not so well haue defended the eyes. Againe, if they had been too long or too bristly they would haue bin an impediment to the sight. In some men saith *Aristotle* when they grow old they encrease vnto such length that they stand in neede to be cut, the reason wherereof he rendreth in the 15. Chapter of his second Booke *de partibus Animalium*; because they are placed in the coniunction of the bones which in old age are loosed, and so a greater quantity of vapour yssueth from their disjunction. But how the disposition of the minde may be obserued from these haire according to *Aristotle* in the 9. Chapter of his first Booke *de Historia Animalium*, and how the ancients (as *Cicero* reporteth in his oration for *Roscius*, and in the first booke of his Offices) placed a part of the Soule in the eye-browes, *Bauhine* hath well declared in his Booke *de partibus externis*, to whom we refer him that desireth further satisfaction.

Why they grow long in old men.

The middle place betwixt the eye-browes which for the most part is without haire is called by *Rufus* and *Pollux* *μεσότης*, in which place *Straton* the Philosopher as *Plutarh* reporteth placed the seat or principall residence of the Soule.

These Eye-browes although they be drawne vp by the muscles of the forehead; yet in some men (saith *Iulius Casserius Placentinus* out of whome we haue taken their fig. (there are two muscles found in the *occipitium* or nowle of the head [*tab. 4. fig. 1. C. the other in the second fig. at a. is retracted above the nose like the pannicle innerted*] which leading the skin of the head backward doe also draw the eye-browes with it, as we shall shew in the fourth Table figure 2. C, where also we will exhibite the orbicular muscle which draweth the eye-browes downward.

How they are moued.

Concerning the vse of the Eye-browes, the Philosopher in the 15. Chapter of his second Booke *de partibus Animalium* sayeth; that as well these as the haire of the eye-lids were created for defence. The eye-browes are as a penthouse to cast off the humors that fall from above: yea saith *Galen* in the 14. Chap. of his 11. Booke *de vsu part.* they are like a wall of defence which receiueth the first brunt of the irruption of any thing that would offend the eyes: which vse also *Cicero* maketh mention of in his second Booke *de Natura Deorum*.

It was not sufficient that the eyes should be walled about with bones, and as it were included or shut vp in bony dens, and defended by the eye-browes from those things which should fall from the forehead, because their forepart was exposed vnto many dangers. For being by nature made soft and tender for the more facile and easie reception of the species or formes of things outwardly directed vnto them, they must needs by diuers wayes be in danger of offence. Wherefore Nature very prouidently hath fenced them with ligaments and lids, wherewith as with lease-dores not only the eyes themselues but their whole orbes are shut vp, and thence it is that those creatures the outward skin or coate of whose eyes is notably hard, as *Galen* well obserued in his Booke *de instrumento olfactus*, haue no eye-lids at all, because their eyes were not so subiect to danger.

Of the eyes lids.

What creatures want eye-lids.

These lease-gates of the eyes are called by the Grecians *ὀφθαλμοὶ* *quasi τὸ βλέπειν* *οφθαλμός*, that is, *The Coats of the Sight*. Thence also they are not vnfitly called by a Poet *ὀφθαλμοφύλλα*, that is, *The leaues of the Eye*. *Cicero* calleth them *Palpebra*, either because in their sudden and frequent motions, they doe *Palpitare* that is tremble, or else because they are often subiect to a trembling weaknes. *Pliny* calls them *Gena*; *Festus* *Cilia*.

The names of the eye-lids.

The eye-lids are two in each eye, for it is cut through the middest and diuided into an vpper and a lower, for in both the corners they are manifestly continued. The vpper [*tab.*

Whether the
lower lid bee
moueable.

The lower lid
is only moue-
able in Birds.

The lower
eye-lid why
lesse.

Whereof the
eye lids are
compounded.

The reason of
their compo-
sition.
The thinnes
of their skinne
and mem-
branes.

1, and 3. E] in a man is much more mouable then the lower, which by some is thought to be immouable of it selfe and onely moued by the motion of the cheekes as *Archangelus* conceiueth. So *Galen* seemeth to say in the ninth Chapter of his tenth Booke *de usu partium*, but more plainly in the 10. Chapter and in his fourth Booke *de Locis affectis*, with whom also *Vesalius* consenteth and *Laurentius* yeeldeth a reason, for, saith he, what neede was there that the lower eye-lid should be moueable seeing by the motion of the vpper downward the eye is closed to his bottome, and by the motion thereof vpperward the eye againe is sufficiently opened? But *Platerus* thinketh that the lower eye-lid is moued something vpperward when we shut our eyes. And with him *Bauhine* is of opinion that the lower lid is moued by a Muscled, although his motion be farre more weake and lesse conspicuous then that of the vpper. For if both the eye-lids were made for the vse of the eyes then was it necessary that either the vpper should moue downward, or the lower vpperward, or the one meete the other. Now we finde by Dissection that in the lower lidde there is a semicircular Muscled as well as in the vpper, and in a creature aliue if we marke the eye well, we shall perceiue the lower lid to moue though not so manifestly as the vpper; but in Birds (as *Aristotle* obserued in the 13. Chapter of his second Booke *De Partibus Animal.*) the lower eye-lid is onely moued.

Neither could so sodaine and quicke motions come from the vpper lid alone, because the motion downward would haue needed a longer time then was fit for so quicke dispatch, and therefore they sooner meete if they ioyne to assist one another. But the vpper lid in a man and in those creatures in whom the lower is not so swiftly moued is larger, because it was to be let downe much further then the lower was to be raised vp. On the contrary in birds the lower lid is larger then the vpper.

The lower lid [*tab. 1. fig. 1, 3. F*] is much lesse then the vpper, and if it had not bene so little falling vpon it selfe it would haue bene corrugated, wrinkled or relaxed and haue falne from the eye. And which is more, the eye would haue become bleared, waterish and ill affected. Beside, many things might haue gathered therein which would haue hardly bene gotten out. Wherefore it was much fitter that this lower lid should be but little and sit close to the eye, that so whatsoever getteth within it might be better pressed out. Wee therefore resolute according to our sense, that both lids are moued, the vpper downward and the lower vpperward that they might meete one with another. But because the lower is by much the lesse, therefore is his motion weaker and more obscure, as the motion of the vpper is more eident because it is the larger.

These eye-lids are compounded of skin, the fleshy Membrane, a cote, Muscles, their brim, and the haire. Wherefore their substance is partly soft, partly hard. Soft as it is Membranous and Musculous, hard as it is gristly: for if (saith *Galen* in the sixt Chapter of his 10. Booke *de usu partium*) it had bene onely fleshy and soft, because they are first exposed to danger, they would haue bene sooner offended then the hornie coate of the eye, yea they would easily haue falne, become rugous and would not so equally haue bene stretched ouer all the parts of the eye.

On the contrary, if they had bene hard and bonie, they would not so easilie haue bene moued, neither could the hornie Membrane or coate haue touched them without danger of offence.

It was therefore fit that the eye-lid should bee made of such a substance as should both easily be moued and yet not offend the eye by contaction.

The Skinne of the eye-lid is the thinnest almost of the whole bodie altogether without fat, least thereby their motion should be hindred. Their fleshy Membrane is so thin that together with their Muscles it is scarce so thicke as the Membrane alone which is vnder the skinne in other parts, so that the orbicular Muscles seeme to bee nothing else then the fleshy Membrane distinguished with small Fleshy Fibres, as *Galen* saith of it in the ninth Chapter of his tenth Booke *de usu partium*. And by reason of this tenuitie or thinnesse of the Membrane and skin of the eie-lids, *Aristotle* saith, that their skin is without Flesh, and therefore if it be wounded will not ioyne together againe as it happeneth in the Prepuce or fore-skin of the yard.

The inner Membrane [*Table 1. Figure 5. ee*] which is produced from the *Pericranium* is exceeding thin and light. Thinner and lighter then the *Pericranium* it selfe, polished also that it should not hurt the sight of the eye which moueth immediatly against it. This membrane being produced into a length answerable to the length of the eye-liddes, as also into their

their skin, doth make in the vpper and lower part a round angle, and becommeth duplicated or doubled, to which duplication is annexed a certaine gristly substance harder then a membrane, which they call *τάρσος*, we called it before *the brim of the eye-lid*, and this substance shutteth vp and comprehendeth the duplication before spoken of. The vpper part of this membrane compasseth and as it were subdiuideth the inner superficies of both the lids. The other couereth the exterior roundnesse of the eye about the tendons of the muscles as farre as to the *Iris*, and producerh that coate of the eye which is called *Adnata* (for to it it is continued) [tab. 1. fig. 7. VV] which louingly ioyneth the lid vnto the eye.

Now the thinnesse and the lightnesse of the membranes was necessary to further swiftnesse and suddennesse of the motion of the eye-liddes; for if they had beene heauy they could neither haue beene moued suddenly nor often, which two things were very necessary: the frequency of the motion to meete with whatsoeuer might affect the eye, the celerity to take away all impediments of the sight. It is no wonder therefore if Nature made the body of the eye-lids very thin, smooth and soft, that so they might bee more nimble and prompt to moue at our pleasure.

The motions of both the eye-lids are vpperward and downeward, there is also another motion made by them both together which is circular, wherein both the eye-lids are gathered together. For it was necessary that the eyes should bee opened and shut, for if they had beene alwayes couered with the lid, they could neuer haue receiued the images of their obiects, and if they had alwayes remayned open, neither had they been free from outward iniuries, and beside they would soone haue growne weake by reason of the perpetuall dissipation of their inward light; wherefore it was of necessity they should bee opened and shut. And therefore *Aristotle* in the 13. Chapter of his second Book *de partibus Animalium*, writeth that this motion is by an instinct of Nature not after the guidance of our will, and that the Eyes by that instinct doe winke at any thing that falleth toward them; but this conceit *Galen* reprehendeth in the 9. Chapter of his 10. Booke *de vsu partium*, where hee saith, There are some Sophisters when they could not finde out either the muscles which moue the Eye-lids or the reason of their motion, they became so impudent as to deny that their motion depended vpon our will: but affirmed that it was Naturall like the motion of the arteries and of the heart, esteeming it better to teach a lye then to confesse their owne ignorance.

But this motion although it be voluntary yet it is partly free partly constrained: the free motion is for the couering and custody of the eyes, if haply any thing should be troublesome vnto them, as too strong a light, smoake, dust, a blow or whatsoeuer might happen vnto them from without. That motion we call Constrained which is stirred vp by a corporall affection or serueth thereunto, and this motion is exceeding suddain and swift, and therefore for the most part we do not marke it; whence it was that *Aristotle* rather thought it Naturall then voluntary; for example; when wee haue long time held our eyes open although there be nothing to offend them, yet we are constrained to close them vp or at least to wincke, and that oftner and more suddainly in winter then in Summer, when the winde blows then when the ayre is quiet: It may bee because the eye is not able to endure the touch of the externall ayre, because of the tendons of his muscles, which are of exquisite Sense and exposed almost naked to the aire, hauing nothing vpon them but the thin membrane called *adnata*; beside it hath beene often obserued that the ChrySTALLINE humour it selfe hath bin condensed or thickned with cold to the great detriment of the sight. Wherefore that the eye might not be hindered at all from seeing, nor from preservation of it selfe when neede doth require: the eye-lids were necessarily made with a sudden and swift motion to shut them and open them againe.

Now these motions are performed by two muscles commonly called the muscles of the Eye-lids: but *Archangelus* calleth them *musculi ocularyj*. Neither do others agree in the number of these muscles, for *Galen* and the ancients as also *Vesalius* and *Siluius* doe make two, diuiding the orbicular muscle of which we shall speake anon into two, whereof one, say they, lifteth the eye-lid vp the other depresseth it or moueth it downward. But the truth is, there is onely one muscle which shutteth the vpper lid according to *Columbus*, *Fallopious* and *Archangelus*. *Platerus*, *Bauhine* and *Aguapendens* affirme that that muscle contracteth both the lids. *Laurentius* indeed maketh this muscle double, and yet hee saith that both of them shutte the vpper lid. Hence it followeth that *Galen*, *Vesalius* and *Siluius* were ignorant of the muscle that openeth the eye, which *Fallopious*, *Platerus*, *Bauhine*, *Laurentius* and

The reason of the thinnesse of the lids.

The motions of the lids.

The necessity thereof.

Galen:

The motion double or of 2. kinds. Voluntary.

Constrained.

Aristotle excused.

How cold offends the eye.

The muscles of the eye-lids.

Diuers opinions concerning them.

Aquapendens will haue to be but one, but *Columbus* and *Archangelus* say there are two, the one of them we acknowledge, but that which they call the second we say mooueth the eye round.

The motions therefore of the eye-lids are performed by two muscles, the one *right* [tab. 1, M, tab. 2, B] of which *Galen*, *Vesalius* and *Siluius* were ignorant; and *Fallopins* ascribeth the inuention thereof to himselfe. This *right* muscle which listeth vp the vpper lid is situated within the cauity of the bones; in the vpper part of the Orbe, aboue but neare the muscle that listeth vp the eye it selfe, to which also it is in figure very like and fleshy, but lesse, and hath his originall from the same beginning with the other muscles that moue the eye: to wit backward at the hole of the opticke nerue. This muscle is extended directly to the vpper eye-lid, and is inserted with a broad tendon to the extremity of the lid, which we said was griftly and called *Tarsus*, and contracting his fibres inward draweth the lid vpward; the lower lid of his owne accord falleth downeward into his owne place, and so the eye is opened.

The second muscle which is semicircular [tab. 6, fig. 1, C E, tab. 1, K] or orbicular is called by *Columbus*, *Fallopins*, *Platerus* and *Archangelus* the first muscle of the eye lid, but *Vesalius* & *Siluius* following *Galen* haue diuided it into an vpper and a lower part. The vpper part, say they, listeth the lid vpward, the lower mooueth it downeward. *Fallopins* in his obseruations confesseth that he was a long time of the same opinion with *Galen* and *Vesalius*; but in the yeare 1553. tooke knowledge of his own error being admonished partly by *Oribasius* in his Booke *de dissectione musculorum* in what place he epitomiseth the 29. Chapter of *Galens* Booke; partly by dissecting the eye of a fish, called *Phoca*, which we call a Seale, which fish moueth both his eye-lids. *Laurentius* diuideth it into two, and calleth them the two muscles which shut the lids, whereof one, saith he, ariseth from the inward angle and compasseth the whole course of the hayres. The other ariseth from the same angle and the roote of the Nose, and is inserted into the *Tarsus* or brimme of the lid. But in the description hereof we will rather follow *Bauhine* who saith, That this orbicular muscle is seated betwixt the fleshy membrane and that which is produced from the *Pericranium* or Scull-skin. It is membranous and very thin or slender, yet a little increased by certaine circular and fleshy fibres which it borroweth from the fleshy membrane, & so standeth halfe round in eyther lid. It ariseth with a sharpe beginning at the roote of the Nose in the great and inward angle of the lower lid, where the common future is betwixt the head and the vpper Jaw, from thence it proceedeth all along the latitude or bredth of the lower lid, and is instantly enlarged and returned to the outward angle toward the vpper part of the Orbe, and passing on by the vpper lid is inserted with a sharpe determination into the vpper side of the inner angle, and so maketh an exact circle compassing the outward circumference of both the lids: yet *Fallopins* in his institutions excepteth the inner part at the great angle, from which it is prohibited that it might not be altogether circular.

The vse of this orbicular muscle is that being drawne toward his originall, it might at one and the same time mooue the vpper eye-lid downeward, and the lower vpward, and so ioine them and binde them both together. And that this is so it appeareth as well by the continuity of the fibres in the circumference and in the angle, as also by the motion of the same angle especially if it be a little more constrained, so as wee must needs winke something withall, for then it is perceiued manifestly both by the sight and by the touch. For nothing can be strikely drawne together and made to touch one another vnlesse some parts be drawne vpward and some downeward.

This muscle in respect of his fibres which are continuall, is most truely saide to bee one, but in respect of the two lids may be called two semicircular muscles, for being separated they make each of them a halfe circle, but being ioyned they make the circle perfect.

This muscle *Galen* knew, and in the 9. Chap. of his 10. Booke *de vsu part.* writeth that all the motions of the eye-lids are accomplished thereby. He diuideth it also into two, whereof one seated at the great angle draweth toward the nose, the other (saith he) is seated at the lesse angle and draweth toward the temples.

Moreouer in the traction of the first the lid is depressed; in the traction of the latter it is lifted vp, but because the fibres of this muscle are continuall through the whole lid it cannot be diuided.

Now in the lower lid although it also be moued vpward and downward, yet is there no Muscle which hath *right* motion, but only this forenamed orbicular muscle which draweth it

Bauhine's description of them.

The vse of the orbicular muscle.

How it is said to be double.

it indeed vpward, but rather toward the inner angle or corner, as it were to his beginning; as any man may perceiue by touching that part in himselfe, & yet I know that some thinke this motion proceedeth from the motion of the cheekes.

We determine therefore and conclude, that the motion of the eye-lids is accomplished by two muscles, one *right*, which being in the vpper lid eleuateth it, the other orbicular or round and is in both lids, which when it is stretched doth at the same time draw the lower lid vpwards and the vpper lid downward, and when there is need of a stronger contraction or closer shutting together, then also the orbicular muscle of the eye-browes (of which we made mention before) is drawne in to bee assistant, like as when wee would open the eye more staringly the muscles of the forehead doe much helpe vs.

He that would demonstrate these nice and curious Muscles must haue a very keene and small knife, wherewith hee must separate the skin, in the meane time taking care that hee doe not cut the Fibres of the Muscle, especially in the angles; then shall hee separate the Muscle below at the *Tarsus* or brimme of the lidde, and aboue in the bottome of the eye-brow.

Columbus and *Archangelus* add a third Muscle which proceedeth (say they) out of the same place with the muscle lifting vp the eye-lid, which third muscle is assistant vnto the former, because there is required more helpe to lift a heauie thing vpward then to draw it downeward. But we say that this third muscle of *Columbus* and *Archangelus* is indeede the sixt muscle of the eye.

Wee saide moreouer, that the substance of the eye-lids was cartilaginious or Gristly, hauing respect vnto their extremities or brimmes into which certaine semi-circular cartilages [tab. 1. a a] like the hornes of a halfe moone, round, small and softe are inserted betwixt the skin & the smal Membrane which compassed the lid. These the Grecians call *ταρσους*, but *Plinie* and the interpreter of *Galen* call them *Cilia*. *Hippocrates* in his Booke *de Viden-di acie* calleth this Cartilage *χονδριον*.

Their Vse beside that which we haue remembred before, is to helpe the motion of the eye-lids; for because they strengthen and firme the thin Membranes and hold them distended that they are not corrugated or wrinkled in their motion, it becommeth that the shutting and opening of the eye is equall.

Galen in his 9. Chapter of his 10. Booke *de usu partium* remembreth another vse of them which is also approoued by *Vesalius* and *Fallopins*, to wit, that the muscle which is in the vpper lid might haue a more firme and strong insertion. The same vse also it hath in respect of the haire of the eye-lids, which being established in so firme a substance doe remaine right and immoueable which otherwise would haue falne vpon the eyes. And therefore *Galen* in the seauenth Chapter of his 10. Booke *de usu partium* maketh this the second vse of the *Tarsus*, where he also affirmeth that it is perforated with many small holes which notwithstanding *Platerus* denieth.

The haire of the eye-lids [tab. 1. fig. 1. b b] are called by *Hippocrates* in *Coatis Rheopapises*, as also by *Aristotle*. *Plinie* calleth them *Palpebra à frequenti palpitacione*, because they are often rubbed. The later Anatomists call them *Cilia quod oculos celent*, because they hide the eyes. They are borne with vs into the world, as are also the haire of the eye-browes and disposed in an elegant order, keeping an equall magnitude and number, I say an equall magnitude: for saith *Galen* in the 14. Chapter of his 11. Booke *de usu partium*, if you add any thing to them, or take any thing from them you corrupt or vitiare their Vse, for if they bee fewer or slenderer there may some-thing fall through them to offend the Eye.

Againe, if they be thicker or grosser, they are no more a wall or defence to the eye, but a prison wherein the apple of the eye is hid and obscured, which of all the Instruments of our senses hath least neede of such an obstacle, and therefore saith *Galen* in the place before quoted, our wise Creator hath laide vpon them a law of necessity to keepe continually an equall magnitude, because hee saw it was most fit so to bee for the vse of that member for which they were ordained.

But whereas (and this is *Galen's* obseruation in the 7. Chapter of his 10. Booke *de usu partium*) it was most conuenient that the haire of the eye-browes should couch or fall one vpon another, because they were made to receiue that which fell from the Head before it could come into the eye: these haire of the eye-lids hauing no other vse were made to stand straight, because they should better hinder dust, flies, or any such like things from falling into the eyes.

Againe,

How the lower Lid is moued vpward.
The conclusion concerning the Muscles of the eye-lids.

Of the gristle of the eye-lids called Tarsus.

Their vses.

The haire of the Eye-lids. Their names.

Proportion.

The wisdom of God.

The maner of their position

And reason
thereof.

Againe, they stand not streight vpward to the browes nor directly downeward to the cheekes, neyther do they bend inward to the eye; for if they had stood streight vpwarde their vse had beene forfeited for which they were created, and if they had stood directly downward or beene bent inward, they would haue beene a great hinderance to the sight by breaking the continuity of the visible objects. Notwithstanding as the haire of the vpper lid are bent a little vpward, so are those of the neather lid curued downward, for if they had stood straight out they would haue cast a shadow vpon the eyes and hindered our looking vpward.

Their distance

In like manner there is a conuenient and as it were measured distance betwixt haire and haire: for if they had bin set one far from another many thing might haue falne betweene them which now are intercepted, and if they had touched one another they would haue cast too dull a shadow before the sight. All which the wisdom and prouidence of our great Creator hath by this excellent order and position auoyded. These haire doe neuer grow too long, neyther do they euer fall, vnlesse it be in extreame diseases of that part, although *Aristotle* in the 11. Chap. of his third Booke *de Historia Animalium*, hath a conceite that the vse of *Venus*, especially if it be frequent will make them fall.

Their vses.

Neyther do these haire serue onely for ornament as some haue conceyued, but also to direct the visible spirits and the beames which shoote forth from the inner parts of the eye, for if they be falne away or retorted, a man can neyther see so directly forward, nor so farre off.

Againe, their often twinkling recreates the sight, & breaketh also somewhat the brightness of the object, as well as they intercept those things which otherwise would fall into the eye, being placed as a Net to catch any thing that would rush into them.

Their vessels.

These eye-lids also haue veines from the Iugular veines; and Arteries from the *soporary* or sleepey Arteries, Nerues also from the second coniugation, al which vessels do leade vnto them nourishment, heate and motion.

The bladders
aboue and vnder
the eyes.

That partice which hangeth ouer the vpper eye-lid [tab. 1. fig. 1, 2. g] *Ruffus* the Ephesian calleth *κοίλον*, that is, the hollow: and that which answereth thereto vnder the lower lid is called *υποκοίλον*, or vnder the hollow. [tab. 1. fig. 1, 2. h] And this vseth to swell in the Dropsie, the greene sicknesse, a long fluxe of the *Hæmorrhoides* and of the courses, sometime also when the eye begin to be bleared.

The vses of
the eye-lids,
Aristotle.

It remaineth now that we add a word or two concerning the vse of the eye-lids. Although *Aristotle* in the 13. Chapter of his second Booke *de partibus Animalium* acknowledgeth no other vse of these eye-lids, but onely to couer the eyes, and intercept those things which would fall into them: and therefore saith that fishes haue no eye lids, because they are alwayes in the water: nor shelly creatures because the Membrane of their eye is very hard, and beside they stand deepe in their sockets, yet we haue learned many other vses of them which we will acquaint you with.

Varolinus.
The first vse.

The first and chiefe vse of the eye-lids therefore is, as *Varolinus* well obserueth, to cleanse the hornie Membrane from droffe, for the sight requireth an exact puritie in *medio diaphano* that is, in his *tralucent meane*, otherwise wee cannot see especially so distinctly, as appeareth in troubled water and smokie ayre: wherefore because the hornie coate by reason of the moisture which sweateth out of the glandule, as also by reason of the contaction of the outward ayre is easily obtenebrated or darkned: the eye-lid was made compassed, that at once it might touch the whole eye, and therefore in opening the eye when the lid is lift vp, it sweepeth and as it were polisheth the whole horny coate or Membrane; and this is the reason why when we desire to view a thing curiously we often winke with our eye-lids.

The second.

The second vse of the lids is, that the visible vertue might sometimes be turned from the light, especially in sleepe that a man might take the better rest; and hence it is that in those creatures which want eye-lids, as Locusts, Lobsters, Crabs, and such like insectiles, nature hath provided certaine cauities, whereinto in the time of their repose as into certaine chambers they receiue their whole eyes and shoote them out againe when they looke abroad, for she hath an especial care of this, that euery sense should be kept fit to performe his owne action.

And hence we may imagine the vnnaturall and cruell punishment which the *Carthaginians* inflicted vpon *M. Atilius Regulus*, whom in the first Punicke warre they had at vnawares surprized, who being by them sent to *Rome* (after he had before taken his Oath

to

to returne) did in the Senate-house dissuade them from making exchange of captiues, wherefore when hee returned they cut off his eye-lids and set him in the sunne vntill the brightnesse of the object ouer-came not onely the spirits of his Eyes, but also of his life.

A third vse of the eye-lids is to recreate the sight, least at one time too great number of spirits should be exhausted; for if the eyes should be so long open as wee are awake, they would be wearied, and many things falling vpon their coates would offend them. Againe, if they bee not quite shut vp they direct our sight, if wee desire to take a true ayme at any thing which is somewhat farre off.

Finally, they serue to defend the soft eyes from the incursion of outward iniuries, because it is much better sometimes not to see at all, then by offering to see, suffer our eyes to be offended. And thus much concerning the circumstances of the Eyes. Now we proceede vnto the Eye it selfe.

CHAP. IIII.

Of the Fat and Muscles of the Eyes.

THe parts whereof the Eye consisteth, are five, Fat, Muscles, Vessels, Coates and Humors. The Fat which Anatomists do some of them call *Adeps*, some of them *Pinguedo*, is very plentifull about the eyes [*tab. 1. Fig. 6. T*] especially it is found in those spaces which are betwixt the Muscles and the Nerues. It is also more plentifull at the vpper Muscle, because that is greater and ordained for more frequent and strong motions. In like manner toward the lower side of the Orbe there is plenty of fat, which like a pillowe is laide vnder the Eyes, that with their weight they should not presse themselves vpon the bones. Againe, betwixt the Muscles and the globe of the eye there is abundant fat, that when the Muscles worke the eye should not suffer compression. Finally, there is also fat found neere the Veines and Arteries, whereby the vessels are smeared ouer and their distention preuented in the motion of the eyes.

The vse of the fat, in as much as it is warme, is to heate the eye which by nature is waterish and cold, and beside to defend it from the coldnesse of the outward ayre. And that is the reason why wee neuer feelee any manifest coldnesse or stiffenesse in our eyes. Againe, the humidity of the fat doth moysten the Muscles, that they become not exiccated or dried vp in their often motions. The softnesse of the fat keepeth the eyes from being offended by the bones about them. The vntuosity or oylie fatnesse maketh their motion swift and facile, and beside, when the Muscles are somewhat dried, because of their motion and as it were consumed, it affoordeth Aliment vnto them.

The Muscles of the Eyes, although they belong to another place, namely to the Booke of the Muscles, yet because we are desirous to absolue the History of the Senses in this present Booke, we wil take liberty to vary something from our scope and set downe as perfect a description of them heere as we can. And that was the reason why before wee were so large in describing the Muscles of the eye browes and eye-lids, concerning all which we will spare our labour and yours when wee come to the History of the Muscles. Because therefore our eyes were giuen vs as spies and scout-watches that wee might pursue things profitable and eschew that that is hurtfull, Nature made not the eyes immouable, for then they should haue discerned onely that which is opposite vnto them, for so saith *Aristotle* in his second Booke *de partibus Animalium* and the 10. Chapter, *Cernimus per directum*, that is, we see by a straight line; not in euery position saith *Galen* in the eight Chapter of his tenth Booke *de vsu partium*, because oblique, side, backward, higher and lower Objects do not fall in with the ball of the Eye. Nature therefore hath so disposed the Eyes that they moue and returne themselves on euery side at their pleasure. But *Galen* addeth in the place before quoted, that not onely the eyes are moued but also the necke and the head are made moouable for the behoof of the eyes, because there are six positions of place vnto al which the eye ought to moue; that is to say, vpward downeward, foreward backward, on the right and on the left.

It was therefore of necessity that the eyes should haue other helps beside their owne motion,

The third vse.

The parts whereof the eye is compounded.

In what places of the eye the fat is found.

The vses of the fat.

Why the muscles of the eye are described in this place.

We see by right line.

tion, for the eyes are not mooued forward and backward, partly because there was no absolute necessity, and partly because it was impossible; it was not necessary they should moue forward saith *Aquapendens*, because the eye doth not attaine vnto the light but the light vnto the eye, which in a moment enlightheth an infinite space euen vnto the eye, yea inlinuateth it selfe thereinto.

But the wise Creator hath made a mends for the defect of this motion of the eyes by the helpe of the motion of the head, which out of hand conuerteth it selfe to see those things which the eye could not by his proper motions perceiue. Moreover, that wee might see whatsoeuer is behind our backe (which could not be done onely by the circumuolutions of the head) Nature hath so prouided that the thighes can carry the body round. In like manner the motion of the eye vpward is assisted by the backward motion of the head and of the whole spine, which they haue experience of that strue to tak view of the pinnacle of a high Steeple: so also the motion of the eye downeward is furthered by that motion of the head and of the necke which is forward.

Seeing therefore it was necessary that the eyes should bee moued with voluntary motion; and all voluntary motion is made by muscles, therefore our wise Creator hath given vnto them diuers muscles whereby their motions are very sudden and expedite. Hence it is that *Aristotle* in the eight Probleme of the seuenth Section calleth the Eye *The most noble part of the body*: yet saith he, the left eye is more nimble then the right. Now whereas the motions of a mans eye are fixe according to *Galen* in the third Chapter of his first Book *de motu musculorum*, it followeth necessarily that the eye must haue fixe muscles; but *Galen*, *Vesalius* and the rest of the Anatomists as *Columbus* sayth, being accustomed onely to describe the eyes of beasts haue added a seauenth muscle, and those fixe also which they haue described they haue misplaced. But wee are to describe the muscles of the eye of a man, that seauenth which belongeth to beasts is deuided into two, into three, and sometimes into foure.

In men therefore as wee haue said there are fixe muscles according vnto the fixe motions of a mans eye, foure of which motions are *Right*, that is to say vpward, downeward, to the right hand and to the left; the two motions remayning are oblique, to which belong two oblique muscles whose vse is to rowle the eye about. Notwithstanding one of these is exactly *oblique*, the other partly *right* partly *oblique*. All these muscles are seated on the backside of the Eye within the cavity of the Scull, whither they accompany the opticke nerue and so remayning in their position, the eye and they together doe make a Pyramidal or turbinated figure. [table 1. figure 6, 7.] Among these muscles the thicker and more corpulent are the *Right* which haue all the same structure, originall and insertion, and do passe straight all along the length of the eye; the oblique muscles are lesse fleshy, yet very like one another.

All these muscles of the eye are small that they might be sooner mooued; but that which helpeth most the volubility of their motion is the round figure, which is the nimblest of all others, as we may perceiue by the roundnes of the heauens.

The eye therefore being round as are also the muscles thereof, is euen in a moment conveyed ouer the whole heauen, and the head it selfe is therefore mooued very suddainly and swiftly, because it toucheth vpon the bone whereon it resteth with a narrow point.

The foure *Right* muscles meeting and touching one another toward the roote of the nerue optick, doe arise with a sharp beginning from the lower part of the bony orbe which is made by the wedge bone, hard by the passage through which the nerue of sight or the opticke nerue doth yssue. I know well that *Vesalius* is of opinion that they arise out of diuers parts and into diuers parts are inserted. Againe for their matter, he conceiueth they arise from a commixture of the *Dura mater* which compasseth the optick nerue and a nerue of the second coniugation. *Platerus* thinks that they arise from the membrane which compasseth the orbe of the eye, and that membrane which inuesteth the opticke nerue. *Aquapendens* imagineth they proceed from the *Pericranium* or Scull-skinne. *Laurentius* disputeth about their originall on this manner; They erre, saith he, which thinke the muscles of the eye doe arise from the inner thicke membrane which compasseth the opticke nerue, for this is altogether against sence; they could not, saith he, arise from a membrane nor they ought not. They ought not, because a membrane of an exquisite sence compasseth the nerue, which nerue the muscles in their motions would compresse, and so the sight would bee offended. They could not because they are not established vpon a firme foundation.

It

As also the
motion of the
thighes

Why their
muscles are
many.

Why fixe.

How many
motions the
eye hath.

The figure of
the eye.

Why the mus-
cles are small.

Why round.

The right
muscles.

Diuers opini-
ons about their
originall.

Table 2. Figure 1. sheweth many muscles of the Eye in their owne seate.
Figure 2. sheweth the Eye rowled upward whereby his muscles may be perceived.
Figure 3. and 4. sheweth the muscles of the Eye, separated before and behind with their nerves.
Figure 5. Is the Eye of an Oxe, with his muscles severed as Vesalius doth shew it.

TABVLA II.

A, The eye lid.

B, the Tarsus or gristle where the haire grow.

C, the muscle lifting vp the eye lid.

D 1, 3, 4, the right upper muscle of the eye in 3, and 4 with the nerve.

E 2, 3, 4, the right lower muscle of the eye, in 3, and 4 with the nerve.

F 1, 2, 3, 4, the right externall muscle of the eye.

G 1, 2, 3, 4, the right internall muscle of the eye.

H 1, 2, 3, 4, the oblique superior muscle or the pulley, whose tendon is marked with a and the pulley with b.

I 2, 3, 4, the oblique inferior muscle of the eye.

K 1, 3, the opticke nerve.

a 1, 2, the tendon of the oblique superior muscle.

b 1, 2, the sayd pulley, a small gristle where-through the tendon doth passe, and in the 3 and 4 pulled from the bone.

c c c c c 3, 4, the moving nerves of the eyes.

a b 5, the second muscle of the eye lid lying in the cavity of the eye, whose broad tendon b is inserted into the eye lid.

y 5, the haire of the eye-browes.

d e 5, two right muscles leading the eye vpward and downeward.

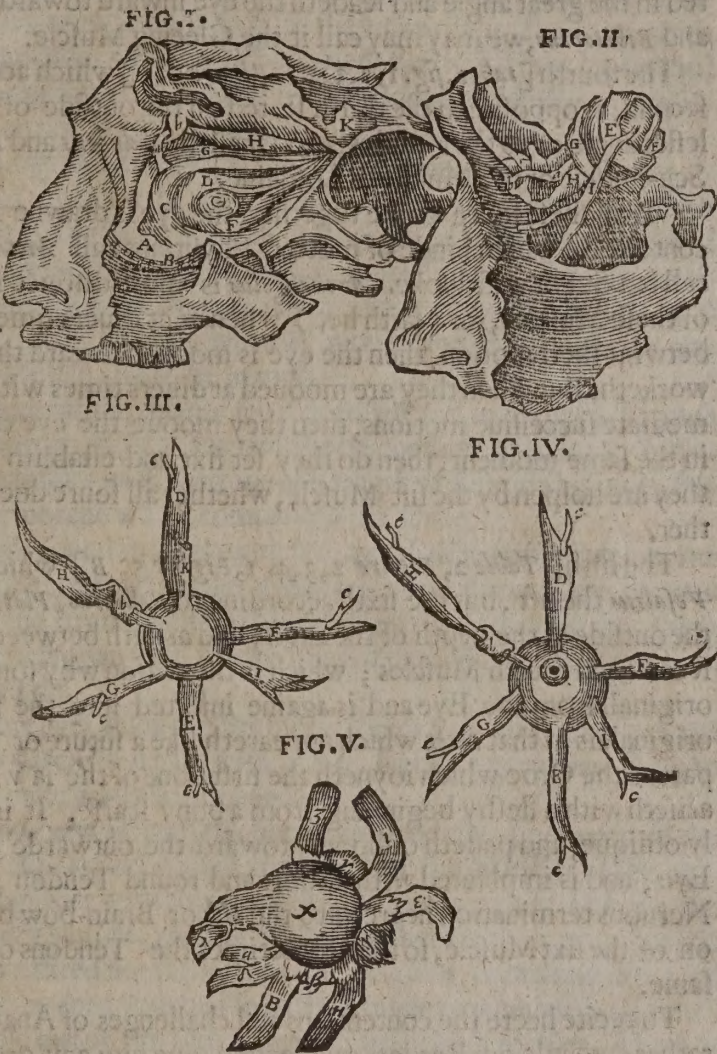
z u 5, two right muscles moouing vnto the right and left side. B 1, 5, two oblique muscles lightly turning the eye. x 5, the seauenth muscle which may be deuided into more. l 5, the Opticke nerve.

It remaineth therefore, saith *Laurentius*, that they must arise from the inmost depth of the orbe or cavity. But we rest vpon *Bauhins* opinion for their originall.

Their whole bodies throughout their whole course are fleshy, and their bellies beare out round as they come forward. But they determine a little about the middle of the eye into a broad thinne and membranous tendon wherewith they compasse the whole eye before, and grow very strongly to the horny Tunicle neare vnto the Iris or Raine-bow in the greater circle: and these tendons ioyned together doe make that nameles coate of *Columbus* and white of the eye.

For wee conceiue that this whitenesse is caused rather by the tendons of these muscles then that it properly belongeth to the coate which we call *Adnata*. And so much shall bee sufficient to haue spoken in generall of the muscles of the Eye. Now wee come to a more particular description of them one by one.

The first [*tab. 2. fig. 1, 3, 4. D fig. 5. d*] which is the third according to *Vesalius*, and *Galen* also in the 8. Chapter of his 10. Book *de usu partium*, is seated aboue; fleshy it is and round, thicker also then the rest, greater and stronger then the second, because it lifteth the eye vpward toward the brow. For there is greater strength required to lift a thing vp, then to pull it downe. The names of this muscle commonly given by Authors are, *Attollens* and *Superbus*, the *Lifter* and the *Proud* muscle.



Their inserti-
on.

Whence the
whitenesse of
the eye proceedeth.

A more parti-
cular descrip-
tion of the se-
uerall muscles.

The

The second which according to *Galen* and *Vesalius* is the fourth [Table 2. Figure 2, 3, 4. E. figure 5. 1] is opposite vnto the former and placed in the lower part; it draweth the eye downeward to the Cheeks, and therefore needed not bee so great as the former, because the eye declineth easily with his owne waight. It is called *Deprimens* and *Humilis*; the *Depressor* and *Humble* Muscle.

The third [tab. 2. fig. 1, 2, 3, 4 G. fig. 5, 2] according to *Galen* and *Vesalius* the first, is seated in the great angle and leadeth the eye inward toward the nose, and is called *Adducens* and *Bibitorius*, we may call it the Gleeing Muscle.

The fourth [tab. 2. fig. 1, 2, 3, 4 F. Figure 5. 1] which according to *Galen* and *Vesalius* is the second, is opposite to the third, seated on the outside of the eye which it draweth to the lesser angle or to the temples, and is called *Abducens* and *Indignatorius*, we may call it the Scu-muscle or the Muscle of Disdaine.

Their Vse.

If all these foure worke together, the eye is drawne inwarde, fixed, established and contained, which kinde of motion Physitians call *Motus Tonicus*, wee in our Language call it a Set or wist-look. *Archangelus* is more distinct in the assignation of the motions of these Muscles, for (saith hee) when as at diuers times they are moued with any pause betwixt their motion, then the eye is mooued toward the originall of that Muscle which worketh. But when they are mooued at diuers times without any pause, that is, with immediate successe motions, then they mooue the eye round: but when they all mooue in the same moment, then do they set fixe and establish the Eye immooueable, wherein they are holpen by the fift Muscle, whether all foure doe mooue apart or do worke together.

The fifth [Table 2, Figure 2, 3, 4. 1, Figure 5. B] which is also according to *Galen* and *Vesalius* the fift, but the sixth according to *Fallopins*, *Platerus*, and *Laurentius*; is seated in the outside at the depth of the cavity and ariseth betweene the eye and the Tendons of the second and fourth Muscles; which is the reason why some haue thought that it taketh his originall from the Eye and is againe inserted into the same. But the very place of his originall is at that cleft which appeareth like a future or seame of that bone of the lower part of the Orbe which ioyneth the first bone of the iaw with the fourth. Sometimes it ariseth with a fleshy beginning from a bony scarfe. It is slender, round, short and exactly oblique, and passeth obliquely toward the outwarde angle as it were to embrace the Eye, and is implanted with a short and round Tendon, degenerating into a thinne and Nervous termination neere vnto the *Iris* or Brain-bow but obliquely, hard by the insertion of the sixt Muscle, so that sometimes the Tendons of them both, serue one and the same.

To recite heere the contentions and challenges of Anatomistes about this Muscle would rather entangle our Readers minde then giue him any great satisfaction, especially seeing those learned men to whom so nice disquisitions will not seeme tedious, may repaire to those fountaines from whence we haue drawne our by-streame, and therefore wee passe on to the vse which is by the contraction of his Fibres to rowle the eye obliquely downeward to the outward angle.

His originall.

The sixt [Table 2. figure 1, 2, 3, 4. H. figure 5. 1] which is the sixt also according to *Galen* and *Vesalius*, but the fift according to *Fallopins*, *Platerus* and *Laurentius*, is seated on the inside and the vpper part, yet vnder the right Muscles, and is partly right and partly oblique. It ariseth from the same place with that Muscle which draweth the eye directly vnto the inner angle at the side of the Opticke Nerves passage, which is in the very depth of the Orbe.

His end or Tendon.

It endeth as well in man as in brute beasts into a round, small and long Tendon, [table 2. fig. 1, 2. 4] almost at the vtmost brimme or edge of the inward angle. This Tendon is reflected through a smal gristle hollowed like a Cane and scituated in the greater angle, which *Fallopins* first of all men called *Trochlea* or the Pulley, and thence proceeding obliquely to the right angle [tab. 2. fig. 2, b. but in the third and fourth figure it is shiuen from the bone] toward the vpper part of the eye, it is inserted betweene the first and the fifth Muscles with an oblique line, all which time the foresaid Tendon is compassed about with a certaine Ligament as it were with a sheath.

His progresse. *Fallopins* his *Trochlea* or pulley.

His insertion.

This Muscle being drawne inward toward his originall with his Tendon hee turneth the eye in a circular motion to the inward Angle. These two turning Muscles the one vpper the other lower, are called *Circulares* & *Amatorij*, the rowling or glauncing Mus-

Muscles, some also call the sixt *Musculum Trochlea*, or the Muscle of the pulley.

The seauenth Muscle which is for the most part found in brute beasts, excepting the Ape and Fishes, is placed [tab. 2. fig. 5. *] vnder the former fixe, and hath of it selfe that figure which the former fixe do together make. It is short and compasseth round about the Opticke nerue, [Tab. 2. fig. 5. A] yet is there some fat betweene them. Proceeding forward it is dilated and embraceth the whole globe of the eye euen to the roote. It maketh also a circle like as the foure first did at the *Rainbow* make a circle with their chords or Tendons: at his insertion, which is into the hard tunicle of the eye, it becometh fleshy and may be diuided into three or foure; so as *Galen* in the fourth Chap. of his fift Booke *de dissectione Musculorum* maketh a doubt whether it be one Muscle, or double or treble.

The vse of this Muscle is to tie vp and strengthen the eyes of brute beastes hanging alwayes downward, that they should not fall with their owne weight. It also incompasseth the nerue Opticke thereby making his passage, not onely straight but also warranteth it from distention and from leaning against the bone in violent concussions or suddain motions. *Galen* addeth in the booke before named, that in that motion which we called *Tonicall* or the fixing of the eye; it establisheth the same when we would accurately discerne any small body: for he supposed this Muscle also to be in men.

But Nature or the God of Nature rather, did not see it needfull for mankinde, because his countenance is erected vp to heaven, & if at any time he be constrained to looke downward, he hath all the foure right Muscles with their ioynt strength to sustaine his eye, because their Fibres grow to the Membrane which compasseth the Orbe.

Fallopini addeth an eight Muscle found in Oxen which draweth that gristly Membrane which *Aristotle* in the 12. Chap. of his second Booke *de Historia Animalium* calleth the *skin of the angle*, with which Membrane brute beasts do blinke when they feare lest any thing should fall into their eyes: vnlesse any man shall thinke this is a part of that Muscle which draweth the eye to the outward angle.

To finde out these Muscles of the eye, when the Braine is taken away you must cut the Orbe at each corner euen to the Opticke nerue with a saw, hauing a great care lest the Trochlea or pulley which is in the inner angle be offended.

Next you must separate the *Pericranium* from the bone, and bend the vpper part of the Orbe backward, then take away the fat, and so shall you perceiue the Muscles of the eyelids, and of the eyes themselues together with their vessels; and if you would obserue the proper and peculiar motion of euery Muscle, you must preserue them in their proper positions and tie to euery one of them a thred not farre from the Tendons, then draw the thred and the draught thereof will describe vnto you the vse of the Muscle to which it is tied.

You may also take the eye whole out of his Orbe together with the Trochlea, which is in the inner angle, and so demonstrate what you please. And thus much shall be sufficient to haue spoken of the Muscles of the eyes. Now we proceede vnto their vessels.

CHAP. V.

Of the vessels of the Eyes.

Of the same reason for which we intreated precisely of the Muscles of the eye in their History, we will also handle their vessels more distictly in this place, and passe them ouer more lightly in the booke of Vessels.

The vessels therefore which are sent vnto the eye are veines and Arteries, to which are added Nerues, as being common Organs no lesse then the other. The Veines which are sent vnto the eye proceed out of the iugular Veines and leade blood for their nourishment.

The Arteries arise from the *Carotides* or sleepey Arteries, and are disperfed through the muscles to strengthen the inward heate, and to sustaine their life; through which Muscles as also through the fat they are accompanied with Nerues, and distributed through their Membranes, which is shewed in the third Table the second and third figures at *b*.

The Nerues are of two sorts, *Optici* & *Motorij*, that is, *seeing* & *moouing*; they proceed out of the marrow of the braine yet remaining within the scull and making the spinal marrow.

The Opticke Nerue [tab. 2. fig. 1. and 3. K, fig. 5. A, tab. 3. fig. 2, 4, 8. a.] which is called *Visorius* or the Nerue of sight, is on each side one, and these are amongst al the nerues of sense the largest, the thickest, the softest, and *Galen* also saith the longest in the third Chapter of the 16. Booke *de vsu part.* They are of a rare texture compassed with both the Meninges. [tab. 3. fig. 2, a b c] They are the greatest and thickest of all the Synewes, that so abundant

Bbb

faculty

The 7. belonging to a beast.

Why a man hath not the 7. Muscle.

How to make dissection best to find out these Muscles.

The vessels are here fully handled. Veines.

Arteries.

Nerues.

Opticke.

Why the greatest and thickest.

faculty might be transported to the eye, that it might sooner haue sense of the light, and be manifold wayes affected.

Why softer.

Galen out of
Herophilus.

Where they
are distinct.
Where yni-
ted.

The vses of
their coniun-
ction.

The vse of the
optick nerues.

They are very soft saith *Galen* in the fift Chapter of his seuenth Booke *de placitis*, that they might be sooner affected because they are nerues of sense and a sense so very necessary, for al sense is perfected by receiuing and suffering. They are softer then any other, because they are affected by the light alone, which they receiue also very much broken. They are the longest of all the rest, because the way is long from their originall to the Orbe of the eye. Their texture is rare and thin, and therefore *Herophilus* beleueed that they were perforated: and *Galen* thereupon called them *meatus visorios*. For in the third Chapter of his 16. Booke *de usu partium*, hee noteth out of *Herophilus*, that they are in their inside perforated all along their passage, and that perforation was the reason why they were made so large.

By these *Galen* thinketh not onely that the faculty of sense is transported, but also the Anima spirits in which the faculty is established, that so their sense might be more abundant and strong: whereas through other Nerues he conceiueth that the vertue or faculty onely is carryed as we may perceiue in the 12. Chapter of his tenth Booke *de usu partium*, and in the fifth Chapter of his 7. Booke *de placitis*. These Opticke nerues in their end and in their originall are distinct, but at the middle of their progresse about the saddle or seate of the wedge bone, before they fall out of the scull becoming a little broader, the right is vnited with the left [*tab. 21. lib. 7. fig. 1. G G*] so that they make the forme of the Greeke χ . not by cleauing the one to the other, or by intercussation, or that one rideth ouer the other, but by perfect and absolute vnion & confusion of their marrows they are so ioyned that one cannot be separated from the other, [*tab. 21. lib. 7. fig. 1. H*] for it is a very rare thing in Anatomie to find them separated.

The vse of this coniunction is, partly that the *Pupilla* or sight of the eye might look vpon the same plaine least otherwise the visible objects should appeare double because the eyes are double: partly that the *Idea* or formes of visible things might be vnited and so the faculty of sight be common to both sides, because the visible spirit may passe from one eye to another in a moment for the more certainty of the sight: And this is prooued if we presse or inforce one eye vpward or downward, for then all things appeare double: wherefore as it was conuenient that the eyes should be paralels; so also the nerues, which because of the motion of the eyes might decline from the right line, especially seeing the muscles do compasse them and cleaue vnto them: for when one muscle onely whether it be the vpper or the lower is moued, the eye also is rowled to one side. And therefore Nature hath worthily ioyned the Opticke nerues together, that euen in such motions the faculty might be wholly conuayed to eyther side. And this appeareth to be true because if you put your hand betwixt your eyes along the length of your Nose, so that you cannot see the object you intend with both eyes, you shall perceiue that you see more obscurely on either side, then if you looke vpon the object with one eye shut vp, for then the faculty which was before dispersed vnto both, is vnited into one. Adde also this third profit of the coniunction, that the soft nerues hauing a long way to go, might thus bee made strong and established, because Nature could not sustaine them with any ties or knots of Membranes. After their coniunction, they are instantly disioyned, and each nerue issueth through his proper hole which is framed in the depth of the Orbe out of the scull [*tab. 21. lib. 7. figure 1. above H*] and so the right attaineth to the right, and the left vnto the left eye, and there are implanted.

In a man they are inserted on the backside into the center of the horny coate [*see the third tab. fig. 2, 3, 4, 8.*] because onely man can looke directly forward. In brute beasts as in oxen and horses, whose eyes are much farther asunder, they attain by a line notably oblique vnto the compasse of the eye and do not determine in the Center. Hence it is that the eyes of brute beasts doe see the earth on eyther sides to direct their gate and to finde out their nourishment. These Opticke nerues when they are come vnto the eyes are dilated saith *Galen* in the 1. Chap. of his 10. Booke *de usu partium* and like a membrane each of them incom- passe the glassie humour; *Galen* also addeth in the same place that they are inserted into the Christalline humour.

The vse of these Opticke nerues is to leade the visible faculty from the braine, which in the eyes is gathered vnto the visible formes, where the Nerue is dilated into the Membranes of the eye. For if this Nerue be obstructed as it is in that disease which the Arabians call

cal *Gutta serena* the cleare drop, the action of seeing is altogether taken away or intercepted. And so much concerning the Opticke Nerves.

Gutta serena.

The Nerves of Motion are on either side one, which sendeth a small surcle to each Muscle by which it is mooued [*tab. 2. fig. 3, 4. sheweth this*] (as he may perceiue who diligently shall separate the Originall of the Muscles from the Nerue) which also is spread abroad into the Membranes. These moouing Nerves in their originall are continuall, that is, the right is ioyned with the left; whence it commeth to passe that when one eye is mooued the other also followeth the same motion; for they proceede ioyntly out of one point as it were in the fore-part of the spinall Marrow, so that the same object and the same light, after the same manner and at the same time insinuateth it selfe into either eye, that the sense and discerning might be one and the same; and this maketh much to the perfection of the sense that one and the same thing might not appeare double, which doubtlesse would happen if one eye might be mooued vpward and the other downward at the same time. That this is true you may easily learne if with your finger you either depresse or lift vp one of your eyes, for then all objects will appeare double, one higher another lower. But if you mooue your eye toward the side, because the *pupille* or *Sights* are in the same line, the objects will not seeme double. Wherefore *Galen* in the 13. Chapter of his 10. Book *de usu partium* writeth, that the Diameters of the visible Cones must bee placed in one and the same plaine, least that which is one do appeare double.

The Nerves of motion.

Where they are continuall.

Demonstrations hereof.

Hence it is, that in the palsy and convulsion of the Muscles of the eye the patient often seeth double Objects, because the eyes do depart from the same plaine. So also when the Opticke Nerves are either conuelled or relaxed the *pupilla* or *Sight* not beeing in the same line, all things appeare double, which also for the same cause happeneth oftentimes to men when they are drunke.

From these Instruments Veynes, Arteries and Nerves are deriued vnto the eye abundance of Spirits Naturall, Vitall and Animall, which are properly called visible spirits: wherefore according to the plenty of the Spirits conteyned in the eyes, their magnitude as also their splendor or brightnes is greater or lesse. And hence it is that when men are nere their death their eyes become little, languid and obscure, as also those that do too much follow veneriall combats haue their eyes small and extenuated, so also we see that in living men the eyes are full and turgid, but when they are dead, they become lesse as also laxe and rugous, for the presence and absence of the spirits maketh a difference betwixt a living and a dead eye.

The spirits of the Eyes.

Againe, according to the diuers disposition of the spirits and of the eyes from them, we are able by our sight to distinguish and iudge oftentimes of the affections of the mind, which is a cleare argument and euen liable to our sense, that the body of a man is full of spirits, which thing *Galen* also in the 10. Booke *de usu partium* prooueth by an elegant and demonstratiue argument. For (saith hee) if vpon the closing of one eye you do attentiuely marke the *pupilla* or sight of the other, you shall perceiue it in a very moment to be dilated, because a greater quantity of spirits doth fall into the Grapic coate which wee call *Vnea*, through that coate which is called *Reticularis* or the Nette, where they dilate the hole of the *Vnea*, which hole is properly called *Pupilla* or the sight and Apple of the eye. Finally, that the eyes are full of spirits is hence conuined, because they are sometimes obscure, dull and languid or weake, sometimes bright or shining, quicke and apprehensue. But least these spirits which are of an admirable finenesse and subtilty might exhale or euaporate they are kept in and retained by a thicke, thight and strong Membrane which is called the Horny coate.

Diuers arguments to proue there are spirits in them.

CHAP. VI.

Of the Membrane of the Eyes.

¶ Auing declared the muscles and the vessels of the eyes and now remooued them away, the eye it selfe round like a bowle appeareth [*table 2. fig. 3, and 4. table 4 fig. 2, and 3.*] which may be compared to an egge, both for the figure and construction. To an Egge I say which consisteth of Membranes, the shell which is an indurated Membrane and a thin Membrane vnder it, and humors, the white and the yolke: So the globe

The eye compared to an Egge.

of the eye hath membranes and humors. Membranes that being of a watery nature it might better be contained in his position and the humors by them encompassed, which membranes had need to haue a more solid substance, beside they are a great furtherance to the sight: Humors onely for the sight.

The Membranes of the eye.

Their number very diuerse according to authors.

Concerning the number of the Membranes the authors are at great difference. *Hippocrates* in his Booke *de Locis in Homine* acknowledgeth but three, the vppermost thicke, the middlemost thinner, and the third thinnest of all which containeth the humors; but in his Booke *De Carn.* he saith they are many. The later Grecians reckon foure, *Siluius* siue, *Vesalius* fixe, *Galen* in the 7. Chap. of his 10. Booke *de vsu partium* seuen; vnto whom *Fuchsius* and *Aquapendens* do consent. Wee will diuide them into two kinds, some are common to the whole eye, some are proper to the humors; the common Membranes are the *Cornea* and the *Vnea* the horny and the grapy coates. The proper Membranes are those with conteyne the Christalline and the glassie humors. But whereas there are commonly reckoned seauen, *Adnata*, *Cornea*, *Dura*, *Vnea*, *Choroides*, *Aranea*, and *Retina*, whereto some haue added those which are called *Vitrea* and *Innominata*, we will run thorough them all after our Anatomical order.

First *Adnata*.

The first is called *Adnata* which is the 7. according to *Galen* in the second Chap. of his 10. Booke *de vsu part.* so called as it were *Nata circa oculum*, bred about the eye. *Galen* calles it *επιεσφυον*, because it cleaueth on the outside of the other membranes of the eye, whereupon it is also called *Adherens* or the cleauing Membrane. This is the vtmost. *Aquapendens* supposeth that it ariseth from the *Periostium* & tendons or chords of the Muscles. It first offereth it selfe before Dissection together with the transparant part of the horny Membrane lying vpon the white thereof.

Whence cometh the white of the eye.

The *Periostium* is alwayes next vnto the bone, vnlesse it be where it produceth the eyelid, for hauing thereto attained it maketh an angle and so is doubled, one part of which duplication compasseth the lid of the eye, the other part [tab. 1. fig. 6, 7, 8, V] maketh this *Adnata* or adhering Membrane, which becomming thinner in the fore-part onely where the white of the eye appeareth, couereth the same and determineth or endeth in the greater circle of the *Iris* or *Rain-bow*, where it is continued with the horny Membrane. [tab. 1. fig. 7, 8, V. and tab. 3. fig. 1. d]

Coniunctiua.

It is said to be white from the colour, although saith *Aquapendens* it be not indeed white but onely appeareth so, because the Tendons of the Muscles lying vnder it do represent a kind of whitenesse. But *Hippocrates* in *Coacis* calleth it λευκον, the white of the eye. It is a smooth Membrane, and by interposition thereof the eye is fastned to the orbe and to the inner bones, and it serueth instead of a Ligament to all the bones about the eye. Hence it is called commonly *Coniunctiua* a *Coniungendo*, because it ioyneth together al the Membranes of the eye, thereby making it firmer and stronger, or rather because at the *Iris* or *Rainebow* it is ioyned to the rest of the Membranes.

The vse of the *Adnata*.

In like manner it tieth the eye to the eye-lids & to the head, & in a word it defendeth the eye from the hardnesse of the bones, it ioyneth it with the bones, the lids, and the rest of the coats, whereby it is so established that in violent motions it doth not fall out of his orbe, but is freely mooued; and besides it couereth the Muscles which mooue the eye and keepeth them in their proper seats, but because it hath rather the vse of a Ligament then of a membrane, we thinke it approacheth nearer to the nature of a Ligament.

The vessels of this coate.

This coate or Membrane or Ligament whether you list to call it, is sprinkled with many smal Veines [tab. 1. fig. 6, 7, 8, V] and Arteries, which commonly when the eye is in perfect health do not appeare. Sometimes they grow very red and being full of blood they strut therewith and so become more conspicuous as in the inflammation of the eye. For as *Hippocrates* hath it, sometime this white groweth red or blackish, or is full of blacke Veines; this Membrane or coate it is which communicateth to the eye the sense of Touching, because neyther without nor within it hath any sense at all, and therefore the pain which proceedeth from the eye-lids molesteth the eye only by reason of this Membrane.

The 2. Coate *Innominata*.

The second Coate of the Eye is called *Innominata* by some, as if it had beene but newly found out, whereas *Galen* knew it well enough, and in the second Chapter of his 10. Booke *de vsu partium* reckons it for the sixt Membrane. It ariseth from the Neruous Tendons or Chords of the Muscles and determineth neere the *Iris* vnder the *Adnata* or *Coniunctiue* Membrane: and these Tendons do encrease the whitenesse of the eye, because they haue a bright *Candor* or whitenesse. But being nothing else then the Chords of

Table 3. Figure 1. The eye of a man. Figure 2. The eye of a horse. Figure 3. The eye of a dog. Figure 4. The eye of a cat. Figure 5. The eye of a lion. Figure 6. The eye of a bear. Figure 7. The eye of a tiger. Figure 8. The eye of a leopard. Figure 9. The eye of a panther. Figure 10. The eye of a cheetah. Figure 11. The eye of a cheetah. Figure 12. The eye of a cheetah. Figure 13. The eye of a cheetah. Figure 14. The eye of a cheetah. Figure 15. The eye of a cheetah. Figure 16. The eye of a cheetah. Figure 17. The eye of a cheetah. Figure 18. The eye of a cheetah. Figure 19. The eye of a cheetah. Figure 20. The eye of a cheetah.

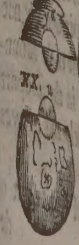


Table 3. figure 1. sheweth the Membranes and humors of the eye by lines drawne after the manner of a true eye.

Figure 2. sheweth the horny coate with a portion of the Opticke Nerue.

Figure 3. sheweth the same divided by a transverse section.

Figure 4. sheweth the Vuca or Grapy coate with a portion of the Opticke Nerue.

Figure 5. The Grapy coate of a mans eye.

Figure 6. The Horny, Grapy, and the Choroides.

Figure 7. The interior superficies of the Grapie coate.

Figure 8. The Posterior part of the horny coate together with the saide Net coate separated from the Eye.

Fig. 9. The coate of the vitreous or glassy humor cald *Hyaloides*.

Figure 10. Three humors ioyned together.

Figure 11. The forward part of the Christalline.

Figure 12. The Christalline humor covered yet with his Coate.

Figure 14. The Christalline of a mans eye.

Fig. 15. His Coate.

Fig. 16. The watery humor disposed upon the Christalline round

Fig. 17. The hairy processes beameinglie sprinkled through the fore side of the coate of the glassy humor.

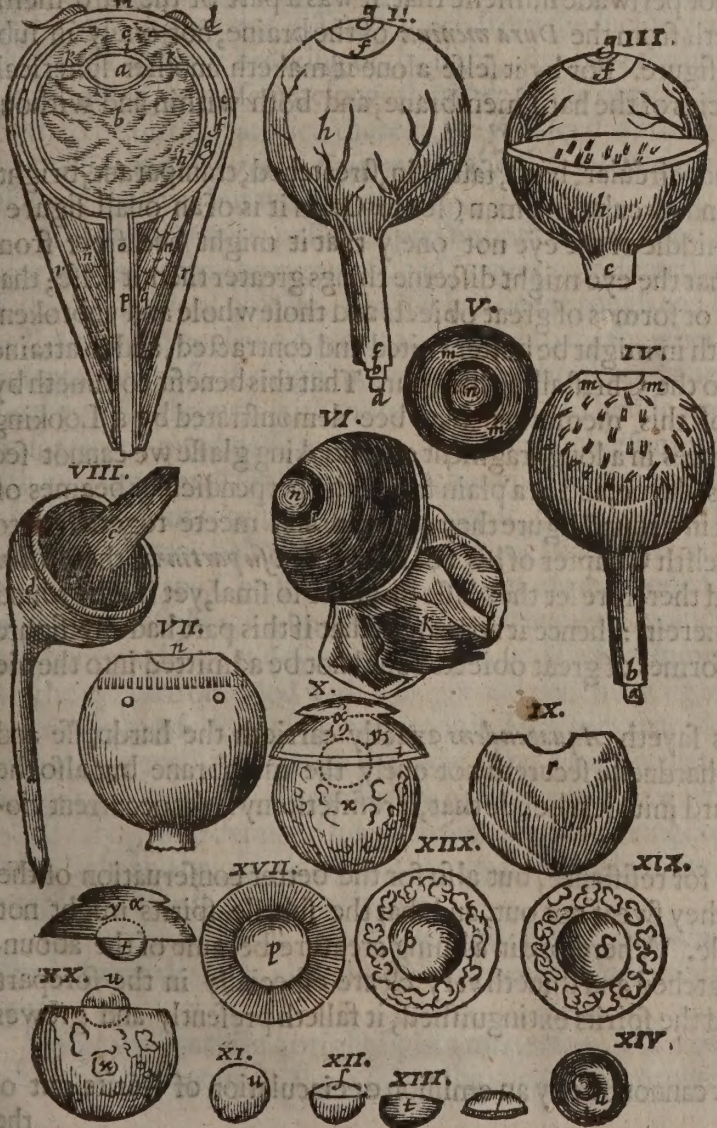
Fig. 18. The fore side of the glassy humor.

Fig. 19. The place of the watery humor.

Figure 20. The glassy humor containing or comprehending the

TABVLA III.

FIG. I.



The explication of the first Figure by it selfe.

- a, The Christalline humor.
- b, The Glassy humor.
- c, The watery humor.
- d, The utmost coate called *Adnata*.
- e, The darke part of the horny Tunicle which is not transparent.
- f, The Grapy coate called *Vuca*.
- g, The Net-like coate called *Retiformis*.
- h, The coate of the glassy humor cald *Hyaloides*.
- i, The coate of the Christalline.
- k, The hairy processes cald *Processus ciliares*.
- l, The impression of the Grapy coate where it departeth from the thicke coate.
- m, The horny coate, a part of the thicke coat.
- nn, The fat betwixt the Muscles.
- o, The optick Nerue.
- p, The *Dura meninx*.
- q, The *Pia Mater* or thin *Meninx*.
- rr, The Muscles.

The explication of the other 19 figures together.

- a 2, 4, 8, The Optick Nerue.
- b 2, 4, The thin *Meninx* clothing the Nerue.
- c 2, 3, The thick *Meninx* clothing the Nerue.
- d 8, The posterior part of the horny Coate.
- e 8, The coate called *Retina* gathered together on an heape.
- f 2, 3, The Rainebow of the eye.
- g 2, 3, The lesser circle of the eye or the *pupilla*.
- h 2, 3, Vessels disperfed through the *Dura Meninx*.
- i 3, 6, The Grapy coat, but i, in the 3. Fig. sheweth how the vessels doe ioyne the hard membrane with the Grapy coate.
- k 6, the horny or hard membrane turned ouer.
- l 3, 4, Certaine fibres and strings of vessels, whereby the grapy coate is tied to the horny.
- m 4, 5, the impression of the Grapy coate where it recedeth or departeth from the horny coate.
- nn 4, 5, 6, 7, the *pupilla* or Apple of the eye.
- oo 7, the Ciliar or hairy processes.
- p 7, the beginning of the grapy coate made of a thin membrane dilated, but p, in the 17. figure sheweth the ciliar processes sprinkled through the fore-part of the glassy humor.
- r 9, the bosome or depression of the glassy humor receiuing the Christalline.
- s 12, 15, the bredth of the coat of the Christalline.
- t 12, 13, 14, 16, the posterior part of the Christalline humor which is sphericall or round.
- u 11, 14, 20, the fore-part of the same Christalline depressed.
- x 10, 20, the amplitude of the glassy humor.
- y 10, 16, 19, the amplitude of the watry humor.
- z, 10, the place where the glassy humor is distinguished from the watry by the interposition of the *Hyaloides* or coate of the glassy humor.
- a 10, 16, the place where the grapy Coate swimmeth in the watry humor.
- g 18, the Cavity or depression of the glassy humor which remaineth when the Christalline is exempted or taken from it.
- d 19, the cavity or depression of the watry humour made by the same meanes.

of the muscles, it cannot be properly called a membrane but a part of the muscles, which together with them must needs be demonstrated, notwithstanding if any man list to stand vpon it and call it a membrane we will not gainsay him.

The vse of it.

The vse of it is, that by the interposition thereof the muscles might be more fitly inserted into the horny membrane [tab. 2. fig. 5. sheweth the same.]

The 3. coate,
Cornea.

The third coate of the eye is called *Cornea*, which is the first according to *Hippocrates*, and may well be called the thicke and hard coate both in respect of his substance and of his originall, because it is produced from the hard *Meninx* or the *Dura mater* which inuesteth the opticke nerue. And here we may take knowledge of the admirable wisdom of our Creator, who (as *Galen* hath excellently obserued in the 2. Chapter of his 10. Book *de vsu partium*) whereas in no other place he hath separated the *Meninges* from any Nerue which are produced with them, but hath led them along with the nerue that they might be nourished and covered: onely in this place after the nerue is inserted into the cie, hath separated both the thicke and the thin from the nerue it selfe; yea made them thicker and harder then they were when they encompassed the braine. For when this membrane is implanted into the backpart of the eye [tab. 3. fig. 3. c.] it is dilated and maketh an orbicular or round membrane [tab. 3. fig. 2. and 3. exhibite it] which compasseth the whole eye, although it be not in euery place alike, neyther haue one and the same name; for the forepart is translucent but the backpart is not so; wherefore some immitating the Arabians of this membrane haue made two. For because the sight did stand in need of transparencie, this membrane, when it hath attayned vnto the middle of the forepart of the eye iust against the *Chrystalline* humor, it is so condensed that it degenerateth into a horny substance, which forepart [tab. 3. fig. 1. c. m.] is called *κερατοειδης Cornicularis*, that is Horny, because in the middle as farre as the extent of the Rainbow it is like a thin and polished horne of a Lanthorne, not only in transparency by which meanes it receiueth the light, but also in his substance, because it may be sliuen or deuided into diuers flawes. And that was the reason why *Fallopins* in his obseruations could not perswade himselfe that it was a part of the hard membrane because, saith he, it differeth from the *Dura meninx* of the braine, not onely in substance but also in thicknes and in figure. For by it selfe alone it maketh another sphericall cavity arising beyond the superficies of the hard membrane, and both within and without is free from any connexion.

How it is
spred ouer the
eye.

Why it is
compared to a
horne of a
Lanthorne.
Fallopins his
opinion.

The forme
and dispositi-
on thereof.
Why round
and circular.

This horny membrane is round, circular, hard, fast, thin, streatched, transparant, bright, polished and smooth. Round and circular in a man (for in Oxen it is of an ouall figure) bunching or bearing out in the middle of the eye not onely that it might bee freer from being offended: but especially that the eye might discern things greater then it selfe; that is, that it might receive the *Ideas* or formes of great obiects and those whole and vnbroken, as also that the light which entreth in might be better vnited and contracted, and so attaine through the *Pupilla* or Apple vnto the *Chrystalline* humour. That this benefit commeth by the roundnesse and prominence of this membrane may bee demonstrated by a Looking glasse, for if we desire to see our faces in a long fragment of a Looking glasse we cannot see them whole, because the figure is playne, and in a plain figure the perpendicular beames of the light are not vnited: whereas in a round figure they concur and meete together into a poynt: for *Galen* saith in the twelfth Chapter of his 10. Booke *de vsu partium*, that *Vision* or *Sight* is made by a *Pyramis*, and therefore let the glasse be neuer so smal, yet if it be round wee may see our whole face therein: hence it appeareth that if this part had any figure sauing a circular, the images or formes of great obiects could not be admitted into the cie at all.

Why hard.

It is hard and in some *Fishes* sayeth *Aquapendens* exactly carrieth the hardnesse and rigidity of a horne it selfe. This hardnesse secureth not onely the membrane but also the *Chrystalline* humour from outward iniuries: beside that, it resisteth any light occurrent violence.

Why fast.

Fast and thight it is, not onely for resistance, but also for the better conseruation of the watery and glassie humors that they sweat not out, and that the subtil spirits might not penetrate through it and so exhale. Wherefore in a liuing creature because of the abundance of spirits, it is notably streatched and shineth very cleare especially in the forepart. But when the creature is dead and the spirits extinguished, it falleth presently and growes loose and corrugated.

Hence it followeth that sight cannot bee by an emission or eiaculation of spirits out of the

the eyes, because
but from the ab
although it be cl
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defended by the
simple or single
in the first
thinner then the
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ould.

It is very thin
become thicke it
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light extend it

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are *Fallopins* and
things of the eye

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presentations pa
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haue defended th
sensitive to the sig
communicated vn
that the eyes are o
preience in himse
blinded by trauell
sawdust a very lig
he had a long time
to this light and br
not able to beare so

In like manner
offended with the
fence.

Hence it is tha
will bould his ha

the eyes, because the tention or stretching of a living eye proceedeth from no other cause but from the abundance of spirits concluded and contained within this membrane. And although it be the first and next part of the eye which is exposed to all injuries of cold, heat and whatsoever else might fall upon or bruise the eye, yet by the wisdom of Nature it is defended by the lids, by the hairs, by the bones and by the skinne. Moreover it is not a simple or single membrane but made as it were of many shels or scales, upon which sayth *Ruffus* in the fifth Chapter of his first Booke, there is a cuticle or curtaine spread which is far thinner then the rest of the scales, that if haply one of them should bee gnawne asunder, the rest might suffice to containe and defend the ChrySTALLINE humour. *Auicenna* maketh it foure-fold.

It is very thin, for sayth *Galen* in the third Chap. of his 10. Booke *de usu partium*, if it had beene thicke it might indeede haue beene a defence vnto the eye, but it would haue cast a perpetuall darke shadow vpon it, and would haue hindered the passage of the light; whereas now being thin it transmitteth any light or brightnes freely and without delay: so that the ChrySTALLINE humour may discern the true portraictures and representations of all visible objects; wherefore also it is transparant, cleare and bright because it should be more fit for the transmission of illumination, for so we see that the thinner a horne is the better doth the light extend it selfe through it.

It is also stretched, for if it had beene corrugated or wrinkled and so vnequall, it must needs haue lost his roundnesse, smoothnesse and transparancie; and so the sight would haue beene much hindered. An experience whereof we haue in old men in whome this membrane is sometimes so rugous and loose, that eyther they can see nothing at all or very confusedly, for, saith *Aquapendens*, when one plight or fold falleth vpon another and the coate thereupon is duplicated, the membrane becomes thicker and the Apple contracteth it selfe because it is not distended by sufficient affluence of spirits.

It is transparant that it might giue way to all visible formes and representations, and also admit the light which beateth vpon it. But we must consider that this transparancie or lucidity of the membrane differeth much from the lucidity of the aire, that so there might insue a refraction or breaking of the light. But how the light passeth vnto the eye and how it is refracted, because it belongeth rather to the opticke Art then to Anatomy; him that listeth to be further satisfied therein, we will send vnto the writers of the Opticks, such as are *Vitellius* and *Albaren*. *Aquapendens* also the Anatomist hath elegantly written of these things of the eye: but we proceed.

This membrane is polished and smooth that in it the formes of things might better shine and more fitly be receiued, and images represented to the ChrySTALLINE humour most like to the outward objects. For if it had beene rough and full of eminencies and cauities, the light would not haue equally attained vnto it; for where cauities are there doe the representations passe through more easily and brighter; where there is any eminency there doe they passe through with more difficulty, and beside are very obscure. Moreover such an asperity or roughnesse would haue beene troublesome to the eye-lid, as wee see it happeneth when any small substance falleth betwixt the eye and the lid. But being fast, hard and thin, it could not receiue any veines into it, neyther yet arteries nor nerues: neyther if it could had it beene behoofeful, for they would haue hindred the sight, & although it might haue defended the ChrySTALLINE humor from outward offences, yet it would haue beene offensive to the sight with his hardnesse: and finally it would haue abated the visible faculty communicated vnto the eyes from aboue, and haue dimmed or dulled their brightnes. For that the eyes are offended with a bright and vehement light, euery man hath sufficient experience in himselfe. Beside, we reade in Histories that *Zenophons* souldiours were almost blinded by traouelling through the snow. And *Dionisius* that Tyrant of *Sicilia* aboue his prison built a very lightsome and bright chamber which he whitened ouer with lime, & when he had a long time detained his prisoners in a darke dungeon, he suddenly brought them into this light and bright place, where they instantly became blinde because their eyes were not able to beare so sudden a change.

In like manner those that doe labour of the *ophthalmia* or inflammation of the eye are offended with the light: but duskish or greene colours they are able to behold without offence.

Hence it is that if in a bright light a man would looke on any thing that is a far off, hee will hold his hands or some other thing ouer his browes to shadow his eyes that they

Why thin.

Why stretched.

Why transparant.

Why polished and smooth.

That much light is an enemy to the sight.

Dionisius his cruelty.

The greater light extinguisheth the lesse.

be not dazled. So also it hath bene obserued, that those that haue fixed their eyes vpon the Sunne to behold the Eclipses of the same, haue vtterly lost their sight. And this cometh to passe, even as we see a torch or candle lighted and set in a bright Sun is instantly extinguished: In like manner if you light a candle and set it by a great flame, the candle will presently go out, because the lesse light is overcome and dissipated by the greater.

The wisdom
of our Crea-
tor acknow-
ledged by
Galen.

After the same manner in the eye, not onely the splendor of the Christalline humour, but with it also the brightnesse of the glassie humour is dissipated: wherefore the wise and prouident Creator, saith *Galen* in the third Chapter of his tenth Booke *de vsu partium*, hath interposed the coat called *Choroides*, which in many parts is blacke and dusky, and in oxen Greene; which coate nourisheth the horny coate that is next vnto it where they touch one another, and hindereth it also from falling vpon the Christalline humour, although that inconuenience is in part preuented by the roundnesse and prominence of the saide horny coate.

Moreouer, the blacke colour of the *Choroides* in men, and the Greene colour in Oxen, is a medicinable curtaine or shadow for the ill affected eye; and this is the reason that euery man by a naturall instinct, when he is offended with the brightnesse of the light, will suddenly close his eye-lids, making haste thereby vnto the remedy which Nature hath prepared, euen within the eye. And this may be further exemplified by the custome of Painters, who when they paint vpon white tables would soone haue their eyes offended if they did not prepare against it, wherefore they place at their elbowes Greene and dusky colours, vpon which euer and anon they turne their sight, whereby their eyes are recreated and refreshed.

The back-
part of the
horny coate.

The posterior or backward part of this coat which couereth the back-part of the eye and the forepart also vnto the circle, [tab. 1. fig. 7, 8. f] is hard, thicke, darke, or obscure; differing as much from the colour or clearenesse of the horny membrane, as the white of an Egge when it is boyled differeth from the same white when it is raw. It is hard and thick by reason of his originall, although it neither imitate the exterior coate of the nerue in thinnesse, nor the *dura meninx* or thicke membrane of the braine from which that ariseth in thicknesse; as being fourefold thicker then it, for when it formeth the coate of the eye it is thickened and hardened, for it was requisite it should be very hard and very thicke for more strength, because it maketh the whole globe and cavity of the eye wherein the humors are contained: for this membrane it is which fashioneth the figure of the eye into a globous roundnesse, and in that figure conserueth it: it is also made whole, for this coate about compasseth the whole eye so that nothing can issue therout.

Why it is so
thicke.

Add hereto that it receiue the insertions of all the muscles and sustaineth their weight, as also the weight of the fat, and is a Basis or foundation of the veines and arteries [Tab. 3. fig. 3. h b] which neare the nerue behind the glassy humor attaine vnto this membrane and afterward run forward till they be distributed through the coate called *Choroides*. By the mediation of these vessels, as also by smal-ties, as it were by ligaments this membrane cleaueth so fast to the *Choroides*, that they hang one vpon another. [tab. 3. fig. 3. h i] The profit of which connexion is, lest this coate alone should be mooued when the other parts of the eye are at rest, as wee see a cloth wrapped about a smooth bowle will easily slippe, though the bowle be not moued.

Why it is
thicke and
darke.

Fuchsius
Aquapendens.

This membrane is also thicke and darke or obscure, that the *species* or formes of things which are received might shine more brightly, as we see in a looking glasse if it be leaded on the back side we may easily see our faces therein, but not so if the lead be removed. This part is white, and neither in nature nor in colour like vnto the forepart, and therefore some of the late writers as *Fuchsius* & *Aquapendens* haue distinguished it from the forepart, and say, that the limits and edges thereof are continuated with the horny membrane. It is situated vnder the Coniunctiue and Tendons of the muscles, and is generated out of the *dura meninx* which compasseth the Optick nerue, for with it it is continuall, as may be perceived if you separate the coate of the nerue with a sharp knife through his length whilest you come vnto this membrane. It is called by some *σκληρότης* & *σκληροτική* the hard membrane, *Ruffus* calleth it *candida* or the white membrane, although commonly that name be giuen to the *Adnata* or Coniunctiue coate.

Ruffus.
The vie of
this third
membrane.

By the helpe of this membrane is the eye established, as also the next membrane vnto it defended, which is sufficient indeed to defend that which is vnder it, but not to defend it selfe: this also is it which containeth the humors according to their due disposition;

sition; and whereby the Christalline humour it selfe is preferued from the cold and heate of the Ambient ayre.

CHAP. VII.

Of the Grapy Membrane, the Apple, Rainebow and the Ciliar Ligament.

THe fourth coate or Membrane of the eye is called by the Greekes *παρυσίς* and *παῖξ*, in Latin *Fua* or the Grapy Membrane, because the colour of it is like the peeke of a Grape stone or kernell, or it is like the kernell it selfe which is on the outside smooth, but within sharpe and rough; in like manner this Membrane on the out side which is next the horny Membrane is smooth but on the inside which is next the Christalline it is rough or rather vnequall because of the furdles of veins and arteries which reach out of the horny Membrane into it. [tab. 3. fig. 3. and 4. l.] Againe it resembleth the Grape kernell in the colour which is blacke, or rather because it containeth a whitish humour such as yssueth from the grape when the stalke is pulled off.

The 4. coate
of the eye.

The reason of
the name.
His situation

This Membrane is scituated betwixt the *Cornea* and *Retina* vpon which it lieth onely on the backside, but foreward it is betwixt the *Cornea* and *Aranca* and containeth the watery humour of the eye. [table 3. figure 1. c.] It is tyed backward to the Opticke nerue, and the coate called *Retina*: to the horny membrane it adhereth by certaine furdles of veines and arteries [tab. 3. fig. 3.] and to the rainbow by Fibrous ties which are not very strong. Before it is euery way free and loose, that it might be contracted and dilated.

The figure of it is not exactly Globous as the former, because it doth not compasse the whole eye, but in the forepart [tab. 3. fig. 4. m. n. fig. 7. at n.] it is a little pressed inward, where also it is perforated with a round hole.

His figure.

The originall of this coate *Galen* saith in the second Chapter of his 10. Booke *de usu partium* is from the *Pia mater*; [tab. 3. fig. 1. f. fig. 4. and 5.] for when the *Pia mater* or thin Membrane hath inuested the Opticke nerue, [tab. 3. fig. 2. b.] it is presently dilated vnder the *Cornea* to make this Membrane: wherefore it creepeth forward and compasseth the whole eye, excepting the forepart where at the greater circle or rainebow of the eye, it is continued with the *Cornea*, and being reflected backward is duplicated and in the middle perforated, which perforation is called *Foramen vnea*, the hole of the grapy membrane and by a proper name *Pupilla* which we may interpret the Apple of the eye. Notwithstanding it is farre thicker then the *Pia mater*, especially in the forepart where it is double as thicke as it is behind. Againe, it differeth from the *Pia mater* in colour, for the coat of the Nerue which it receiueth from the *Pia mater* is white, but this is blacke on both sides.

His originall.

Moreover, because it proceedeth from the *Pia mater* or thin membrane, it is called also *χοροειδής* especially, because through it there are many vessels disseminated, and because like the Chorion of the wombe it gathereth those many vessels and tieth them together; and this in oxen is easie to be discerned, for in them the vessels do run through the length of the eye in a conuenient distance one from another, from which vessels certaine threddy filaments or small strings do as it were weaue together this membrane like as it is in the *Pia mater* of the braine. From this membrane also the fore said strings and threddy vessels are produced into that coate which we call *Retina* as may easily be perceiued when this Grapy membrane is separated therefrom.

Why it is called
Choroides.

This Grapy coate therefore is full of veines, soft, blacke, and perforated.

His vessels.
Why it is soft.

Full of Veines, that it might nourish the horny membrane: soft that it might not hurt the Christalline humor, and beside might readily moue when the *Pupilla* or Apple moueth, which it would not so readily haue done if it had beene rigid or stiffe.

It is blacke or rather duskish, the better to gather the brightnes of the *Idea* together, and to transmit it through the perforation.

Why blacke.

Finally, it is perforated iust against the Christalline humor, that so the Images of visible things passing through the horny membrane and waterish humour might at length arriue at the Christalline. And although it be moist and soft and neare neighbour to the Christalline, yet is it not offensive thereto; albeit on the outside it be something thicke or rather fast wrought: for as it was fit that this membrane should not offend the christalline humor, so likewise was it as fit that it selfe should not be offended by the horny membrane; betwixt

Why perforated.

the

the transparant part whereof and the chrySTALLINE humour it is seated, and yet it toucheth neither of them.

Furthermore, that the chrySTALLINE humour might not bee offended or touched by the horny coate insinuating it selfe through this hole or perforation, by which the externall brightnes attayneth vnto, and is mingled with the internall; Nature hath set that part of the horny membrane outward, and beside hath disposed about the ChrySTALLINE a thin and cleare humor like the white of an egge; and lastly hath filled the whole perforation with an ayery and bright spirit. And that this place hath such a thin moysture and is full of spirits is hence manifest, because in liuing creatures the eye is stretcht and fulfilled on euery side, no part of the horny membrane remayning loose or corrugated.

What is contained betwixt the grapy membrane and the chrySTALLINE humor

But if you looke into the eye of a dead man before you come to dissect it, you shal find it rugous, and when you haue cut the horny membrane presently a thin humor will offer it selfe (which also in compunctions of the eye doth vsually yssue from the wound) and so the whole eye will become rugous, contracted and loose. Againe, if you distend and stretch the coates when they are separated from the ChrySTALLINE humour, it wil appeare that there is a great distance betwixt them empty, which while the creature was aliue was vndoubtedly filled vp with spirits or humor or both.

The spirits of the eye.

The like also may be demonstrated in a liuing eye, for if one eye bee shut the *Pupilla* or Apple of the other will be dilated, enlarged and distended as a bladder that is blowne vp; what then should distend or enlarge this *Pupilla* or perforation, sayth *Galen*, but only a spirit? And this indeed is his argument whereby he proueth that there is an Animall spirit. For, faith he, this amplification or enlargement hapneth because all the spirits doe assemble themselues vnto the eye which is open, whereas when they are both open the spirits are equally diuided betwixt them. *Galen* also proueth the same thing by dissection; for if you blow vp the grapy membrane on the backside you shall perceiue that the *Pupilla* or perforation will be enlarged. Wherefore it followeth necessarily that all that space which is before the chrySTALLINE humor is filled with spirits and a thinnie humor. The thinnie humor sheddeth it selfe in all the other parts but in the very *Pupilla* or perforation the spirits are gathered together.

The *Pupilla* or Apple of the eye.

This *Pupilla*, is called *νοπή* by *Hippocrates* in his Booke de *Carnibus*; by *Galen* in the fourth Chapter of his 10. Booke de *usu partium* 64. [tab. 3. fig. 4, 5, 6, 7. n] In Latine *Pupilla*, *oculi fenestra*, the window of the eye, *nigrum oculi* & *foramen oculi*, wee vse to call it in our language the Apple of the eye.

It is a hole or perforation of the grapy membrane and is otherwise called the lesse circle of the eye (as the greater circle is called the Rainebow) [Table 3. fig. 2, 3. g] because it appeareth in the center of the eye like a blacke point. Blacke (I say) as well because of the deepe scituation, as also because the coates which compasse it about are of a darke colour. This hole or perforation is not onely lesse then the compasse of the horne, but also there is some distance betwixt them, least otherwise the ingresse of visible images through the horne might be interrupted; wherefore when the grapy membrane commeth to the translucent part of the horny membrane, it is no more round but reflected backward and inclineth toward the chrySTALLINE humour, leauing a hole in the midst which is called *Pupilla*, as *Varolius* hath elegantly deliuered.

The fig. of it.

This *Pupilla* or Apple of the eye is in man and some other creatures as Dogges very round: in many brute beasts, as Oxen, Sheepe and Goates it is longer then round, of an Ouall fig. or like a circle compressed in the midst, which compression is dilated or contracted according to the motion, eyther proceeding from the Animall spirit, or from the light: so that the figure thereof is sometimes round, sometimes long, sometimes wide sometimes very narrow, as in a Cat whose *Pupilla* is like a narrow and long cleft; *Aquapendens* faith, that in a Pike it is of the figure of a cone.

How the *Pupilla* is contracted and dilated. *Galen*; *Aquapendens*.

The dilatation and contraction of this *Pupilla* or Apple of the eye, *Galen* ascribeth to the Animall spirits, but *Aquapendens* thinkes that the hole of the *vnea* or grapy membrane, (which is all one with the *Pupilla*) is dilated or constringed according to the strength or weaknes of the light that beateth vpon it. For in a stronger light it is contracted the better to defend the chrySTALLINE humour, which is oftentimes offended by a strong light. In a lesfer or weaker light it is dilated to helpe the sight to discerne of many visible things, which otherwise would not appeare; (And therefore those that complaine of the weaknes of the eyes and sight must haue them viewed rather in an obscure and darke, then in a Lucide or bright

bright place) and so it cometh to passe that a strong light doth not offend the eyes, because it is admitted to the cristalline humour in a lesse quantity; nor a weake proue insufficient because it is received in greater quantity.

That the motion of the *Pupilla* is not from the Animall spirit as from the efficient cause hee proueth, because a strong light attenuateth the spirits, diffuseth them, and so should consequently enlarge the *Pupilla*. On the contrary, a weake light doth dull and diminish the spirits and so the *Pupilla* should be straitened, whereas common experience teacheth vs the quite contrary: wherefore saith *Aquapendens*. I conceiue that the dilatation and contraction of the Apple of the eye proceedeth from a proper faculty of the Grapy coate, which Faculty notwithstanding is stirred vp by the externall light which entred into the eye, and yet we see that in Suffusions and Catarracts the *pupilla* is dilated and constringed when a strong light cannot offend such eyes because it hath no free passage, the Catarract or cloud being interposed betwixt the light and the sight: howbeit even in such Suffusions if one eye be shut the *pupilla* of the other is dilated, which can bee from no other cause but onely from the spirits.

The vse of this perforation or *pupilla* is to transmit the visible images to the Christalline humour: for (saith *Galen* in the fourth Chapter of his 10. Booke *de usu partium*,) vnlesse the Grapy coate had heere beene perforated al the parts of the eye had bin created in vaine, because the Christalline humor hath no communion with his obiects but onely by this perforation of the grapy Membrane, and therefore according as this apple of the eye is dilated or contracted, so do we see better or worse. And hence it was that *Galen* in the second chap. of his first Booke *de symptomatum Causis* hath well obserued that the dilatation of this Apple of the eye, whether it be an originall fault in Nature or happen after by accident, is alwayes a great weakner of the sight. On the contrary, the coarctation or straightning of the *pupilla* if it be naturall is the cause of the quickenesse and vigour of this sense, for when it is notably dilated the animall spirit which floweth into the eye cannot fill the whole space which is before the Christalline humor; whereas on the contrary when the *pupilla* is contracted or gathered together the space is sooner fulfilled.

Add heereto that for the perfection of sight it is very necessary that the visible species or Formes should flow vnto the eye by a right line and so passe vnto the Center of the Chrystalline with a pointed angle; for so they make the better impression, and therefore the perforation or the *pupilla* is very narrow that the lines produced from the Circumference thereof as from a basis might touch the center of the Cristalline in an acute angle; for if the *pupilla* be so dilated that the lines produced from the circumference thereof do make a right or obtuse angle in the center of the Christalline, then is the sight not onely offended but abolished.

Hence it appeareth that the naturall latitude or straightnesse of the *pupilla* maketh much for the strength or weaknes of the sight, especially if the distance betwixt the visible obiect and the organe of the sense be proportionable. But to returne vnto the grapy Membrane, of which this apple of the eye is but a perforation.

This Membrane according to the difference of the parts thereof hath diuerse colours, for on the outside where it toucheth the horny Coate it is blacke; on the inside where it respecteth the watery and Christalline humours it is blacke or dusky. But where it maketh the greater circle which we call the Rain-bow (according to the diuers temper of the Braine and the eyes saith *Laurentius*) it is sometimes greenish, sometimes skie coloured, sometimes blacke. Finally, the backward part of this Membrane where it first ariseth from the *Pia mater* is whitish, presently it groweth greenish, then nearer vnto a blew, all which colours may be best discerned in the eye of an Oxe. This blacke colour (as *Galen* sayth in the third Chapter of his tenth Booke *de usu partium*, where hee speaketh of a skie colour because he described the eye of an Oxe) is very worthy of admiration, because there is no such colour found else-where in the whole body. And although in some eyes it is lesse or more blacke then in others, yet in all it is eyther blacke or browne, that the Christalline humour being therewith couered might better collect and gather his brightnesse together. For as a small light in an obscure and darke place is better perceived and shines brighter then in an open and light place, and maketh those things which are about it better to be perceived; so the brightnes that is enclosed within the eye becomes more bright, and the visible species do better appear in the cristalline humour, because the

Objections
against *Aqua-*
pendens.

The vse of the
Pupilla.

A narrow ap-
ple is the best
sight.
And why.

Diuers colours
of the Grapy
Membrane.

What profite
the eye hath
by his blacke
colour.

How the colour of the inside differeth from the colour of the outside.

the inner circumference of the whole eye is inuested with this obscure and darke Membrane, by whose shadow the chirstalline is compassed; so that his brightnesse returning backe from the blacknesse and obscurity of the membrane is vnited better into himselfe. And so (as *Aquapendens* hath well obserued) that light which is but weake, or but moderately strong doth better appeare in the Chirstalline then that which is much stronger, as whereby the inbred light of the humour it selfe is ouercome.

Againe, we say that the darknesse of the colour of this membrane maketh much to the collection and refraction of the spirits. For when the Chirstalline is too much affected by a vehement light, then we close our eyes, and the spirits turning themselues vpon those darke colours are refreshed, as before hath bene shewed in our History of the horny membrane. Wherefore also about the *pupilla* it is thicker, because it should cast a greater shadow vpon the Chirstalline in that place where the light hath his accessse, for on the backside it is compassed with the thicke and fast horny coate. And for this cause betwixt the horny membrane and the Chirstalline humour this coate is blacke. But this blacknesse on the inside of the coate where it respecteth the humors, seemeth to be bred with the coate it selfe, but on the outside where it respecteth the horny membrane, I conceiue it is but accidentary because it will colour a mans finger that toucheth it, and may easily be washed off so that the membrane will remaine white; but the colour on the inside will not die or taint the finger, for if it were so those bright bodies which it respecteth and compasseth would be soyled by that blacknesse, and so loose their purity. Some are of opinion that this blacknesse is the thicke excrement which is separated in the nourishment of the Chirstalline humor, as also that the watery humor is the thin excrement of the same.

A mans eye is of diuers colours.

Now as this blacknesse is perpetuall in all creatures on the outside of this coate, so on the inside, especially where it respect the glasse humour, the membrane is sometime browne, sometime purple or skie coloured (whence it was that *Galen* in the fourth Chapter of his 10. Booke *de usu partium*, called it a skie coloured coate) and sometimes green as in oxen; but where it is perforated on the foreside and respecteth the shining or transparent part of the horny Membrane it is not in man of one and the same colour; yet so that it is alwayes of that colour which we see in the Rainbow of the eye, according whereto we say a man hath blacke or browne, or skie coloured, or a Goates eye, which saith the Philosopher is an argument of a good disposition: so that the same *Aristotle* in the fifth Booke *De generatione Animalium* and the first Chap. hath well obserued that among all creatures onely man hath eyes of diuers colours, for other creatures among all of the same kind haue eyes alike, excepting horses, who sometimes haue wayle eyes.

The Rainbow of the eye.

The Raine bow called in Greeke and Latine *Iris*, hath his name from the similitude of the Raine bow which appeareth in the clouds, because this greater circle of the eye [tab. 1. fig. 7, 8, f. tab. 3. fig. 2, 3. f.] is distinguished with diuers colours which shine through the horny Membrane. *Galen* in the second Chapter of his 10. Booke *de usu partium*, saith, that in this Raine bow there are seuen circles one within another, all differing in thickenesse and colour, which proceed from the Membranes. But how nice a peece of businesse were it in dissection to offer to shew all these circles distinctly without confusion? surely so hard a matter it were to accomplish as vaine when it were performed, Some haue called this *Iris* *secundum a Crowne*.

Diuers opinions of the cause of the Rainbow.

There are many opinions of the causes of so great variety of colours in this circle of the eye, and if you wil giue me leaue I wil acquaint you with what other men haue conceiued, and then deliuer that opinion which I follow my selfe.

Empedocles.

First of all therefore *Aristotle* in the first Chapter of his fifth Booke *de generatione animalium* maketh mention of *Empedocles* his conceit, who compoundeth the eye of fire and water. The skie coloured eye saith he, is when the fire beareth the sway, and the blacke eye when the water exceedeth the fire.

Aristotle.

Aristotle in the place before quoted refers the variety of the colours to the plenty or scarfity of humors, and maketh demonstration of his opinion by the example of ayre and water: for, saith he, if you looke vpon a deepe water, or a thick ayre they will seeme black and obscure. But if there be but a little of either, then wil their colour appeare blewish and bright. This conceit of *Aristotles*, *Columbus* reprehendeth, but gratis; for he addeth no reason against him.

Galen:

Thirdly, *Galen* in *Arte medicinali* is of opinion that the plenty of splendor & scituation of the Chyrtalline & watery humors is the cause of this variety of colours. The eye, saith he, be-

becommeth skye-coloured, either because of the plenty or splendor of the Chrystalline humor or by reason of his prominent scituation, whereto he addeth the paucity and purity of the watery humor. The eye is blacke when the Chrystalline is little or scituated somewhat too deepe, or because it is not exquisitely bright, or because the watery humor is somewhat more plentifull and yet not pure. *Vesalius* reprehendeth *Aristotle* and *Galen* in these words, which indeed are but bare words. This color, saith he, ariseth not from the plenty, defect or tenuity of the humors of the eye, neyther yet from the collection or dilatation of the Apple, and finally not from the depth of the eye or the tenuity thereof.

Fourthly *Auicenna* referres the cause vnto the color of the grapy coate, which as it is diuersly depainted so it bringeth forth in the eye diuers colours: if it be sky-colored the eye is also sky-coloured, if blacke, the eye is blacke. And him doth *Vesalius* follow.

Fiftly, *Auerrhoes* imagines that the whitenesse of the eye proceeded from cold, and the blacknes from heate.

The sixt opinion is that of *Varolius*, who saith, that the cause of the colour is to be referred to the vnequall plenty of the spirit and of the watery humor, which as it falleth in diuers parts of that place so it representeth diuers colors. The color saith he which resulteth from the grapy membrane receding or giuing backe from the horny, is wont to bee called the Rayne-bow from a certaine appearing variety: he calleth it an appearing variety, because in very truth there is not in that place any true diuersity of colours but onely in apparition, because the horny membrane standeth vnequally about the grapy, and so an vnequall quantity of spirits and humor fall betwen them.

The seuenth opinion is that of *Archangelus*, who writeth that the diuers colours in the Raine-bow are caused by the inequality of the veines which are in the grapy coate (which veines are also comunicated to the coate called *Aranæa* or the cob-web) containing in them blood diuersly prepared according to the variety of the parts that are to be nourished, which are much vnlike other parts of the body. He imagineth also that the grapy membrane is not of one colour in men, that their eyes being wearied might be recreated, especially by green, of which there is most in the world; and hence it is that we do often shutte our eyes, that so the spirits that are spent or wearied may be restored and refreshed.

The eight opinion is that of *Laurentius*, who referred the cause to the watery and chrystalline humors, to the variegation or diuers colours of the grapy coate and to the spirits, which opinion also we will follow as seeming most reasonable. For the cause of the sky-coloured eye in respect of the chrystalline humor is the plenty thereof, the splendor & the prominent scituation; in respect of the watery humor the splendor and the paucity, for when the watery humor is but little it doth lesse hinder the fulgent brightnes of the chrystalline.

The blacke eye hath quite contrary causes, to wit the paucity of the Chrystalline humor his impurity and deepe scituation, as also the impurity and plenty of the watery humor.

The colors betwixt these depend vpon intermediate causes.

In respect of the Grapy Membrane, the colours of the eye do differ, as when it is simply variegated or diuersly streyked then is the eye also of diuers colours, because in that place the Grapy membrane is diuersly discolored.

In respect of the spirits the colours of the Raine-bow differ, for thinne, pure, bright and plentifull spirits make it sky-coloured, on the contrary, crasse, impure, cloudy and few spirits may be the cause of this blacknesse.

The vse of this variety of colour in the Raine-bow some referre vnto beauty, or happily by reason of this diuersity of colours the diuers colours of externall things are there better expressed and offered to the chrystalline humors. But in those creatures which see in the night, the Iris is onely a bright place which if it happen in a man, as *Suetonius* reporteth of *Tiberius Caesar*, he also will see in the night.

Finally this grapy membrane some of the new writers, as *Enschinus* and *Aquapendens* imitating the Arabians haue deuided into two parts, the forepart they call *uena*, and the back-part *Choroidea*, and thence is the difference of his names.

From the circumference of the grapy coate [tab. 3. fig. 17.] doe directly proceed certaine small filaments or strings like blacke lines, which resemble the haire of the eye-lids. These strings reach vnto the margent or brimme of the Chrystalline humor, and although they be placed in the cob-web coate yet they compasse the Chrystalline humor round about. By the mediation of these hairy threds the grapy Membrane is ioyned to the circumference of the Membrane which immediatly inuesteth the Chrystalline humor [tab. 3. fig. 7. 0 0] and so

Auicenna

Auerrhoes

Varolius

Archangelus

Laurentius
which is also
the truth.
The causes of
the sky-colored
eye.The cause of
the black eye.The vse of the
colours of the
Raine-bow.

Fallopins.

the cristalline humor it selfe is tyed to the neighbour parts: wherefore because it doth the office not of a Membrane but of a Ligament or Tie, *Fallopins* from the forme calleth it *Ligamentum Ciliare* or the hairy Ligament, others call it *Interstitium Ciliare*, because it disseuereth the watery humour from the glassy.

CHAP. VIII.

Of the Cobweb or Membrane of the Christaline humor. Of the Membrane which compasseth the glassy humor, and that coat called Retina, or The Net.

The Cobweb
or coat of the
christaline hu-
mor.
Divers opini-
ons of his Ori-
ginall.



He Membrane which immediately compasseth the Christaline humor is called in Greeke *ἀραχνειδής*, *Aranei-formis*, that is the Cobweb, most properly is it called *Κρυσταλλοειδής* from the humor whose proper coate it is, yea the very superficies of the same. Some call it the Looking-glasse, because it is bright and transluceid. Some thinke it hath his originall from the *Pia Mater*, and of that opinion is *Columbus*. Others from the coate called *Retina* of the net as *Aquapendens*, but *Archangelus* conceiueth that it is made of the Opticke Nerue dilated and drawne out into a wonderfull thinnesse. But we are of opinion saith *Banhsine*, that it is engendred in the first conformation, together with the cristalline humor which is framed of the purest and brightest portion of the seede. It is a Membrane most thinne (so saith *Hippocrates* in his Booke *de Locis in homine*) very fast, most light, white, bright and shining beyond measure, the better to admit the light and to be changed thereby, (for onely this Membrane dooth indeed receiue and apprehend the affections of the light) and least if it had beene thicke it should haue hindered the sight.

The substance
of it.

The substance of it is much like the inward skinn of an Onion or rather like a spiders Cobweb, for the finenesse I meane, and not for the density or fastnesse thereof. This Membrane couereth the cristalline humor both on the foreside and the backside immediately compassing and establiishing the same. Although I know that *Galen* in the 6. Chap. of his 10. Booke *de usu partium* writeth, that it inuesteth this humor onely there where it toucheth the grapy Membrane, with whome *Archangelus* also agreeth. But that the whole cristalline humor might be more fit for sensation, it was necessary that it should be compassed round with this Membrane, which notwithstanding wee acknowledge to bee thicker, faster and stronger on the fore-side. For because we see before vs, therefore the faculty and power of this sense ought there to be more vigorous, because in that place the light is more strongly vnited by the roundnesse of the cristalline and the refraction of the watery humors. And therefore *Ruffus* calleth it *Visio & Pupilla*, the sight or Apple of the eye. And because in this as it were in a glasse the Effigies or Image of the *Pupilla* doth consist, therefore *Galen* in the place next before quated, calleth it the Idoll or Image of the sight. On the contrary the backpart of it is looser, thinner and more rare.

Why thicker
before.

The vse of it.

If this Membrane be taken away, the figure of the Christalline humor is destroyed; for whereas before it was smooth, equall and polished; now it falleth asunder and becommeth vnequall, not being able to stand together when the bande which conteyned it is remoued. In a word, the cristalline humor receiueth from this Membrane not onely his sensatiue power, nor the forme and figure of his substance, but also his efficacy and virtue. Veines it hath none, but seemeth to be nourished by the Ciliar Ligament.

The coate of
the glassy hu-
mor.

The coate of the glassy humour is called *δακρυειδής*, which *Columbus* and *Archangelus* haue confounded with the cobweb before described. But the trueth is, that their substance is different, for this is thinner then the former and encircleth the watery humor round about least it should either be diffuent or confounded with the watery humor. Other Anatomists haue altogether pretermitted the mention thereof, because they thinke that both humors are involved by the Cobweb Membrane. In the midst of this coate doth the Ciliar or hayry Ligament appeare.

The Net.

The last Membrane or coate of the eye is called *Retina* or *Reti-formis*, [Table 3. fig. 8.] in Greeke *ἀμυδανειδής*, because it resembleth a little round casting Net. This Membrane ariseth from a part of the Braine descending thorough the Opticke Nerue, or if you will, from the marrow of the Nerue it selfe as soone as the Nerue attaineth to the eye, and so hangeth at the very roote of the nerue, from thence it passeth on to the middle of the cie & within the cavity of the grapy membrane vpon which it immediatly lieth, but is not tyed there-

thereto. It is enlarged and like a net or caule compasseth the glassy humor, but without any connexion at all, *Aquapendens* saith, it is inserted into the vtmost circle of the Christalline humor, and that by the meanes hereof the Christalline swimmeth in the midst of the glassy humor as a peece of wood swimmeth in the water. It is soft, reddish, of a mucous substance, not solid and crasse as is the substance of the braine.

The substance thereof.

Wherefore, neither in substance nor in colour is it like a Membrane, and therefore *Galen* in the second Chapter of his tenth Book *de vsu partium* saith, it neither deserueth the name of a membrane nor of a cote, for if you separate it from both the humours and lay it vpon a heape by it selfe, [table 3. fig. 8. 1.] it will seeme to you to be a part of the braine dilated, and therefore *Galen* calleth it the net-like body; *Vesalius* saith it can haue no fitter name then the name of a coate, albeit *Columbus* and *Platerus* are not of his opinion. Veines and Arteries it hath very many and conspicuous; and indeed more (though they be small) then seeme conuenient for the proportion thereof: for all nerues being inuested with a portion of the *Pia mater* wherein veines and arteries doe run, this also receiueth a veine and an artery diuersly branched, whereby Nature hath provided and prepared aliment not only for the Nerue, but also for the humors of the eye. In these vessels therefore is blood contained, not thicke nor faeculent but thinne and fluide, whereby the glassy and Christalline humors might be nourished, which because they are pure bodies do also stand in neede of pure blood.

The vessels thereof.
The prouisor
dece of nature

It is also darke and corpulent not translucent, that it might not be affected or changed by the light.

The first and greatest vse of this Net-like coate is, saith *Galen* in the 2. Chap. of his 10. Booke *de vsu partium*, that when the Christalline is altered, it might apprehend the Sensation, or rather to leade along the faculty of sensation to the christalline humor, because as we saide euen now, it ariseth from the substance of the nerue.

The vse of it.

Another vse of it is, that the visue spirits might be diffused through the christalline humour and the whole eye; to perceiue the alterations of the Christalline and to transport the images of visible things to the braine as to a iudge.

Finally, whereas it intercedeth betweene the Grapy membrane and the glassy humor it keepeth the pure substance of the glassy humor from being defiled with the blackenesse of the Grapy membrane. And so much concerning the membranes or coates of the eye. Now we proceed vnto the humors.

CHAP. IX.

Of the humors of the Eye.

THe humors which are the most noble parts of the eye are contained within their coates, and are three; differing each from other in figure and consistence; yet all bright and perspicuous, distinct in their seates, filling the cauities of the eye, and helping the action of the sight. These three humors are called the Watery, the Christalline, and the Glassy, amongst which the Christalline excelleth in dignity and vse and therefore is called the soule, the center and an inner Spectacle of the eye.

The three humors of the eye.

The watery humor [tab. 3. fig. 10, and 16. y, and 19.] is called in respect of the other humor *tenuis* the thin humour, and by some *Aqueus*, because it is fluide like water and also transparent. And hence haply it was that *Aristotle* maintained against *Plato* that the eye was not fiery but watery. It is also called humor *Albugineus*, because the colour and substance thereof is much like the white of an egge. This is the vtmost of all the humours filling the whole place which is betwixt the foreside of the Christalline, the grapy membrane which is there duplicated, and the horny membrane; sauing that it is accompanied with an ayry and bright spirit.

The watery humor.

What place it hath in the eye.

It is disposed on each side the apple of the eye, stable and not moueable, because it hath in it a kinde of *Lentor* or sliminesse. It is but little (wherein *Vesalius* was deceived) filling scarce the tenth part of the circumference of the eye. In or vpon this humor are those Suffusions made which they commonly call Cataracts.

Where cataracts are.

The vse of it is very notable, as we shall heare afterward, which hath moued vs to doubt whether it be a part generated of the seede as the other humors of the eye are, or an excrement

Table 3. figure 1. sheweth the Membranes and humors of the eye by lines drawne after the manner of a true eye.

Figure 2. sheweth the horny coate with a portion of the Opticke Nerue.

Figure 3. sheweth the same diuided by a transuerse section.

Figure 4. sheweth the Vnea or Grapy coate with a portion of the Opticke Nerue.

Figure 5. The Grapy coate of a mans eye.

Figure 6. The Horny, Grapy, and the Choroides.

Figure 7. The interior superficies of the Grapie coate.

Figure 8. The Posterior part of the horny coate together with the saide Net coate separated from the Eye.

Fig. 9. The coate of the vitreous or glassy humor cald Hyaloides.

Figure 10. Three humors ioyned together.

Figure 11. The forward part of the Christalline.

Figure 12. The Christalline humor covered yet with his Coate.

Figure 14. The Christalline of a mans eye.

Fig. 15. His Coate.

Fig. 16. The watery humor disposed vpon the Christalline round

Fig. 17. The hairy processes beameinglie sprinkled through the foreside of the coate of the glassy humor.

Fig. 18. The foreside of the glassy humor.

Fig. 19. The place of the watery humor.

Figure 20. The glassy humor containing or comprehending the

TABVLA III.



The explication of the first Figure by it selfe.

a, The Christalline humor.

b, The Glassy humor.

c, The watery humor.

d, The vtmost coate called *Adnata*.

e, The darke part of the horny Tunicle which is not transparent.

f, The Grapy coate called *Vnea*.

g, The Net-like coate called *Retiformis*.

h, The coate of the glassy humor cald *Hyaloides*.

i, The coate of the Christalline.

k, The hairy processes cald *Processus ciliares*.

l, The impression of the Grapy coate where it departeth from the thicke coate.

m, The horny coate, a part of the thicke coate.

n, The fat betwixt the Muscles.

o, The optick Nerue.

p, The *Dura meninx*.

q, The *Pia Mater* or thin *Meninx*.

r, r, The Muscles.

The explication of the other 19 figures together:

a 2, 4, 8, The Optick Nerue.

b 2, 4, The thin *Meninx* clothing the Nerue.

c 2, 3, The thicke *Meninx* clothing the Nerue.

d 8, The posterior part of the horny Coate.

e 8, The coate called *Retina* gathered together on an heape.

f 2, 3, The Rainebow of the eye.

g 2, 3, The lesser circle of the eye or the *pupilla*.

h 2, 3, Vessels disperfed through the *Dura Meninx*.

i 3, 6, The Grapy coate, but, in the 3. Fig. sheweth how the vessels doe ioyn the hard membrane with the Grapy coate.

k 6, the horny or hard membrane turned ouer.

l 3, 4, Certaine fibres and strings of vessels, whereby the grapy coate is tied to the horny.

m 4, 5, the impression of the Grapy coate where it recedeth or departeth from the horny coate.

n 4, 5, 6, 7, the *pupilla* or Apple of the eye.

o 7, the Ciliat or hairy processes.

p 7, the beginning of the grapy coate made of a thin membrane dilated, but p, in the 17. figure sheweth the ciliar processes sprinkled through the fore-part of the glassy humor.

r 9, the bosome or depression of the glassy humor receiuing the Christalline.

s 12, 15, the bredth of the coate of the Christalline.

t 12, 13, 14, 16, the posterior part of the Christalline humor which is spherically or round.

u 11, 14, 20, the fore-part of the same Christalline depressed.

x 10, 20, the amplitude of the glassy humor.

y 10, 16, 19, the amplitude of the watry humor.

z, 19, the place where the glassy humor is distinguished from the watry by the interposition of the *Hyaloides* or coate of the glassy humor.

a 10, 16, the place where the grapy Coate swimmeth in the watry humor.

β 18, the Cavity or depression of the glassy humor which remaineth when the Christalline is exempted or taken from it.

δ 19, the cavity or depression of the watry humour made by the same meanes.

ment segregated or separated in the nourishment of the Christalline humor, as *Galen* hath written in his Book *de Anatomia vivorum* in the chapter of the eyes, and after him *Columbus*, *Varolius* and *Aquapendens*. *Anicen* also is of the same minde, saving that he calls it the excrement of the glassy humour. And this doubt is further increased, because we learne out of Anatomy that this watery humour is distinguished from the christalline by the cobweb-like membrane, and therefore should seeme not to be the excrement thereof but a part by it selfe.

Whether it
be a spermati-
call part or an
excrement.

But because no spermatial part being taken away can be regenerated, whereas we know that in wounds of the eye this watery humor may be totally lost and yet regenerated again, we are in doubt vpon what we should resolve. *Columbus* saith, that twise he saw this watery humor lost and recovered againe so as the patient could see with the same eye. And *Varolius* affirmeth that he hath seene as much. These learned and curious Anatomists account it but an excrement, which in many diseases is much wasted as *Platerus* admonisheth vs. But *Laurentius* will haue it to be a living and spermatial part of the eye, not an excrement, because it perpetually keepeth the same figure, purity and quantity. Besides, it is a defence for the Cristalline, and like a spectacle carrieth the images thereto. If it yssue out of the eye it can hardly be restored, it extinguisheth the sight, and finally betwixt it and the Cristalline nature hath interposed a membrane.

The cristalline humor [tab. 3. fig. 11, 13, 15.] lyeth vnder the former; so called because it is exceeding bright like pure Cristall in splendor and transparency, but not in consistence and hardnes: and therefore *Hippocrates* in his Booke *de carnibus* calleth it *Diaphanum oculi*, *Aristotle* in the 9. Chap. of the first Booke *de historia animalium* and in the first Chap. of the 5. Booke *de generatione animalium* called it *κόρη* the *Pupilla* or Apple of the eye. This humor is a *Similar* part of the body and made of the most pure and lucide portion of the seede and the sincerest of the mothers blood. That it is a part may be proued as well by the authority of *Galen* as by reason: *Galen* in his sixt Chap. of the first of his Method and in the first Book *de causis Symptom.* reckoneth it among the parts.

The cristal-
line humour.

Whereof
made.

Beside the definition of a part as well generall as speciall agreeth well thereto, for it is generated in the wombe together with the other parts. It hath a proper circumscription. It liueth. It is nourished and performeth an Act or an office: wherefore *Galen* accounteth both this and the glassy humor among the *Similar* parts. This humor in men is scituated right before, [tab. 3. fig. 1. a] for the membrane which containeth it cutteth the eye into two vnequall parts, the forepart being foure-fold lesse then the backpart. Furthermore, it approaches nearer to the inward angle of the eye then it doth to the outward.

His situation

The reason of this position is, because it was necessary that some bodies should be placed before it, others behind it; some of them to be seruiceable vnto it, some of them to defend it, and some of them to lend it their assistance: but in Oxen it is nearer to the lower part of the eye.

Membrane.

It is compassed by the cobwed-like membrane which, as we said, before is fast and polished, but behind more laxe and rare: when this Membrane is taken off the substance of the christalline humour offereth it selfe to our sight, which is waterish indeed, but not fluid, much like water lightly frozen into a tender yce; and when the membrane whereby it is knit together is remooued, it falleth to the sides and slideth a little downe. This humour on the fore side is compassed with the watery humour, [tab. 3. fig. 10. and 16.] on the backside it sitteth or swimmeth rather in the glassy humour as a bowle swimmeth in the water, [tab. 3. fig. 10. and 12.]

The position
Why it hath
no colour.

It is deuoyde of al colour, for if it had bene red or yeallow all things that are seene would haue appeared red or yellow, as it happeneth with those that are troubled with the Jaundies: wherefore, that it might suddainely receiue all kinds of colours which are cast vpon it, it else is of no colour at all but cleare bright & perspicuous, that it might be altered and changed by the light. For this is the onely cause why euery colour hath power to make alteration therein, yea this humor alone is altered by colours and receiue the images of visible things. Yet is not perspicuous or transparant after the same manner that the watery humour is perspicuous and transparant, because in it there is made a new refraction of the light: wherefore it is faster or more dense that the light in his superficies might bee broken *ad perpendiculum* or with a right line, for so the light is better vnited and strengthened. It is moderately hard that the images might be fastened therein, and thicke yet so that it is translucide, that the light may passe through it. It is smooth and notable slippery, and yet with

the softnesse it hath a *Lentor* or sliminesse, so that if you presse it it will cleave like Glueto your fingers. The magnitude of it is much like a lupine or small pease. The figure somewhat flat like a greater Lentile: whence *Aetius* calleth it *parva sive Lenticularis*.

Before it is almost plain, yet a little rising like a Lentile the better to receiue splendor or brightnesse of the light. Backward it is sphericall or round that it might more safely reside in the glassy humor. At the sides it is something protuberated: but because it should not fall out of his seat but hang suspended as it were in the chamber of the eye: it is ioyned to the grapy membrane by the *Ciliar* or hairy ligament, yet that onely in the greatest circumference of the *Christalline*: but before and behinde it is free, that it might not intercept the continuity of the translucid bodies.

The 3. humor
called *Vitreus*.

His situation

Consistence.

And figure.

The third and humor of the eye is called *vitreus*, [tab. 3. figure 1. b fig. 18, and 20.] or the glassy humor, because in consistence and thicknes it is like to melted glasse, in colour and brightnes to glasse when it is cold. It is scituated in the backpart of the eye especially: somewhat also before, insomuch that it filleth the parts of the cavity of the eye if it were diuided into foure [tab. 3. fig. 10, and 20. x] and is foure times as much as is the *Christalline*, the better to containe the spirits of the sight that they should not too soone be disipated.

The substance of it hath a kinde of consistence, establishment or firmitude in it; yet is it farre softer and thinner then is the *Christalline* that it might better giue way therunto, for the *Christalline* is seated therein: notwithstanding it is not so fluide as the watery humor. The splendor or brightnes of it is equall to that of the *Christalline*; for saith *Aquapendens* they are both of a most exquisite purity, transparency and brightnes.

The figure (as it is in the eye) resemblith the better part of a bowle cut in sunder, [tab. 3. fig. 9. and 20.] for the backward surface is round or conuex: the foreward is plaine, yet in the middest thereof hath it a bosome [tab. 3. fig. 9. r and 18. b] whereinto it receiue the *Christalline* humor. And although it bee compassed about by the net-like coate called *Amphiblastroides* whereby it is nourished from the veines disseminated there through; yet notwithstanding it hath a proper coate of his owne called *Vitreum*, which if it bee broken, this humor presently melteth and resolueth into water.

CHAP. X.

Of the use of the Humours of the Eye and of the Sight.

Aphilosophi-
call discourse
of the vse of
the eye.



Auging declared the admirable wisdome providence and goodnesse of God our Creator in the conformation of this diuine member which wee call the Eye: although we haue spoken somewhat in the History of euery particular part concerning their vse, yet there remaine many things worthy our obseruation touching the humors, which being ioyned to that that hath bin saide before will better absolue and accomplish this discourse of the vse of the eye and the true manner of sight. Which though I must confesse that they are more Philosophicall then Anatomicall, yet because they pertaine to the same subiect, I presume the Reader will not abhor from them.

The proper
objects of the
sight.
Common.

Particular
vses of the
parts.

That the Eyes are the instruments of the sight by which it perceiue all visible things as well Proper as Common there is no man ignorant; Proper as all colours, Common as the figure, magnitude, number, motion and scite, which are sensible qualities common to all the Sences; so that it is truly sayed that the Eye seeth not a *Man* but those things which are visible in a *Man*, as colours together with the scite, figure, magnitude, number and motion of his parts, out of which afterward the Soule collecteth that that thing is a *Man*.

The eye is framed of many parts, all which were created for the vse of the sight. But because in euery organe which is compounded of many parts, there is one similar particle vpon which the action of that organe doth especially depend, it would bee knowne what this particle is in the eye: we answere that it is the *Christalline* humor which is the author of the action, because in it the species or formes of visible things are receiued and by it iudged of.

Beside this, there are some particles without which the action cannot be; as the opticke nerue which leadeth along the faculty vnto the *Christalline*; some also by whose helpe the action is made more perfect, as the membranes and the muscles: and finally, some particles are ordayned for the conseruation of all these, as the Eye-lids and the parts about them.

Seeing therefore the faculty is deriued from the braine by the opticke nerues vnto the eyes,

eyes which are set as scout-watches to take knowledge of the ariual of outward things; that they may better apprehend the knowledge of such outward objects, it was necessary that whatsoeuer is to be perceiued should touch the nerue: for *Aristotle* sayeth in his third Booke de *Anima*, That euery action is made by contaction.

This contaction is here made by a *medium* or meane; for the Sences doe perceiue their objects through a meane. Wherefore seeing the nerue is separated from the visible object, that there may be sight it is necessary there should be a contaction and application either of the nerue to the object, or of the object to the nerue, or else that either of them should be moued in a certaine proportion to the other.

The two first wayes it cannot be, as euen Sence it selfe teacheth vs, & therefore it must be done the third way. If vision be made the third way, then eyther something must proceed from the nerue to the visible objects, or on the contrary something must be sent from the objects to the nerue, or else both must be: that is, Sight must be made either by an emission of spirits, or a reception of beames, or else by emission and reception both together.

Now the spirit is not carryed from the nerue to the thing that is to be seene, for then it would follow that the nerue alone by which the faculty yssueth can absolute and perfect the action of sight, and the iudgement should be made without the eye. Againe, neyther is there any corporeall thing transported from the body which is sent vnto our eyes; for then the objects by continuall diffusion would be deminished. Neither is Vision made the third way, for that a spirit or a beame or a light should yssue out of the Eye vnto the object: and againe something of the object should bee moued vnto the spirit, that so the contaction might be made in the middle, for then the nerue alone would haue sufficed for the action, and the iudgement should haue beene made without the eye. Wherefore we thinke with the Philosopher that this contaction is made by a *medium*, so that a certaine quality with some colour affecting and changing the ayre that is cleare and lucid betwixt the eye and the object doeth transference from the things themselves, the visible *species* by one right line from the object to the eyes, yea to the center of the Christalline humour. So the ayre which is in the middest betwixt the eye and the object leadeth along that which is perceived and first of all the colour; for the ayre is altered by colours which it receiueth by contaction; for euen as the Sunne attayning by the brightnesse of his light vnto the Element of the ayre illustrateth the same; so coulours when they touch the ayre make a kinde of impression therein, for the ayre is alwayes capable of colours when it is cleare, light and illustrated by the brightnesse of the Sunne beames. Vision therefore or sight is made by the reception of visible formes, when the light affected with those formes entreth into the eyes through their translucid bodies. First of all with right beames, afterward diuersly refracted or broken and affecteth the Christalline with some colour, which Christalline as the primary instrument of sight doth in an instant receiue those visible formes whereof refraction is made in the membranes, a perfection in the coniunction of the optick nerues, and finally a perception in the braine. For the light is the proper object of the sight whereby it is moued and affected; Light I say stayned with the formes of colours and external light, for the eye of a man hath not in it any In-bred light, for then he might see in the darke by sending out a light from his eye. Albeit *Suetonius* reporteth that *Tiberius Caesar* had such an eye, and that excellent Philosopher and Physitian *Cardan*, as also *Iohn Baptista Porta* of *Naples* do affirme the same thing of themselves. Some creatures there are we know which see worse in the day time then in the night, and therefore they seeke their food in the night season.

Now because the light thus affected with the images of visible things, must passe through a refraction of his beames, it is necessary there should be diuers translucide bodies. First the ayre through which it attayneth to the eye, then water in the eye in which this refraction might be made. *Plato* indeed who thought that sight was made *extra mittendo*, or by an emission of light out of the eye, thought that the nature of the eye was fiery, yet not such a fire as would burne but onely illustrate; for saith he there is a threefold fire: one shining and not burning, another shining and burning, and the third burning and not shining. But we are taught by Anatomy and by the whole composition of the eye, that the instrument of sight is watery, and therefore *Hippocrates* in his Book de *locis in homine*, saith that the sight is nourished, that is increased by a moist braine. And hereto also may we adde reason, for it is the property of water to receiue; wherefore seeing the formes and images of outward objects must be receiued, it is necessary that there should be water in the eye.

All sense is by contaction.

How many wayes contaction is made.

How sight is made.

Whether in mansie there be an ingenit light.

Tiberius Caesar
Cardanus
Iohn Baptista
Porta

Plato thought the eye was fire.

A threefold fire.

But

How the
formes are re-
tained.

That there
are 4. refractions of the
light in the
eye.

6. in a paire
of spectacles.

Another vse
of the watery
humor.

A third.

A fourth.

A fift.

A sixt.

The vse of
the cristalline
humor.

An axiome in
philosophy.

But because these visible formes should not onely be received, but also retained in the eye, it was necessary that the body of the eye should be made not onely translucent but also dense and fastly compacted: wherefore Nature did not only make the eye watery that there might bee a refraction, but also that this refraction might bee manifold: shee hath created translucent bodies of diuers consistences; for the watery humor is indeed translucent and admitteth the light yet the *Diaphanum* or transparency thereof differs from the transparency of the horny membrane that there might be also a different refraction; this refraction is made from a perpendicular and is in the eye foure-foulde. The first is from the ayre into the horny membrane which is a faster *Diaphanum*. The second from the horny membrane into the watery humor which is a thinner *Diaphanum*; in this watery humor the light is vnited and made stronger, so that it is able to pierce through the third *Diaphanum* which is the cristalline humour, wherein as in a faster substance the light is yet more strongly vnited and so passeth on to the last refraction at the glassy humor of which we shall speake by and by. And as in the eye naturally disposed there are foure refractions, so in the spectacles which make the object both larger and brighter there are sixe. For first of all the light entred into the spectacle which is a thicker *Diaphanum* from the ayre which is a thinner, from the spectacle before it come to the eye it passeth through the ayre again which is a thinner *Diaphanum* into the horny membrane which is a thicker; from the horny membrane into the watery humor which is a thinner *Diaphanum*, from thence into the Cristalline which is a thicker, and finally into the glassy humor so that it proceedeth by course out of a thinner *Diaphanum* into a thicker.

Another vse of the watery humor is to fill vp the empty space betwixt the Cristalline and the forward membranes, as also to keep the horny membrane streatched or tentered and moyst, least if it should grow dry it might be corrugated or wrinkled, and so become thicker and hinder the reception of the visible formes.

Thirdly, the watery humor sayth *Galen* in the sixt Chapter of his 10. Booke *de usu part.* keepeth the horny membrane, the grapy membrane and the Cristalline from exiccation: because the moysture thereof keepeth them transparent without which there could bee no vision at all, for we see that in compunctions or wounds of the eye; when this watery humor is let out and dried vp, the horny membrane which before was turgide and full falleth into it selfe and becommeth darke and rugous.

The fourth vse of the watery humor is to be a defence vnto the Chrystalline, least the horny membrane should touch the Cristalline through the *Pupilla* and offend it with his hardnesse.

The fift vse is to restrain the impetuous or violent occursion or confluence of external colours vnto the Cristalline.

And finally to eleuate or lift vp the formes of visible things as spectacles doe, that they might be more fully and directly perceiued by the sence. For when the images of external things are ariued at the narrow hole of the *Pupilla* they are lifted vp and so exhibited in the watery humour, wherein they are made more perspicuous; and this indeede was the chiefe reason why Nature placed so pure and neate a humor before the cristalline, which is the prime instrument of the sight.

The vse of the Cristalline humour is to be the first and chiefe instrument of the Sight, as wherein it is perfected, and therefore some haue called it the Idol or image of the sight, and *Aristotle* calleth it *Pupilla*, haply because we see especially right before vs. That it is the chiefe instrument of sight may thus be demonstrated. The Philosophers say, *That whatsoever is made to receiue any thing must be utterly free from the nature of that which it is to receiue, because the same thing can neither worke upon it selfe, nor suffer from it selfe.* Wherefore that which is the proper Organe or instrument of Sight must haue in it no colour at all, because it is to receiue all colours. And indeed hereby may we perceiue a thing to be without colour, when if it be placed against any colour it representeth the same, as it is in ayre, water, Crystall and such like: wherefore the instrument of sight must either bee airy or watery, or cristalline.

Airy it might not be, because the colours that are receiued in the ayre do flow through it, making no mutation at all therein, but we know that the instrument doth onely then perceiue and apprehend the object when it so suffereth therefrom that it is made the very same; seeing therefore that the colours doe passe through the ayre and make no mutation therein, it could not be that the instrument of Sight should be airy.

In

In the second place it could not be watery, for though the species and formes of colours make a deeper impression in the Water then they do in the Ayre: yet are not the colours therein so imprinted that a man may behold them in it, but they flow through it also. It remaineth therefore that the instrument of sight must bee Christalline, because that onely can receiue and retaine the visible formes. And this also may be proued by *Autopsie* or ocular inspection, for if you take a beade of Christall and set it opposite against a coloured body, which way soeuer you looke, you shall see the colours in the christall, as if the christall were of the same colour, and did not receiue the impression thereof from those coloured bodies. Wherefore in the Christalline humor colours are not only receiued but also so retained that the power thereof is changed into the colour which it receyueth.

Nor watery.

And the reason hereof is, because there is in the christalline not only a watery moysture, but also a glutinous or slimy, which with his lentor and tenacity retaineth the images or formes of the colours.

But christalline

The chiefe instrument therefore of Sight Nature hath placed within the eye, to weete, a round and gutinous humor most like vnto christall to receiue and retaine the representations of all colours. This christalline humor if you duely consider when it is taken out of the eye you shall perceiue it hath no colour in it, but will represent any colour layde neere it, as if it were of the same colour.

Moreouer, if you cut this Christalline humour in sunder, you shall finde that it is made of a glutinous and slimy moysture. And because sensation is a kind of reception, therefore was the christalline made round.

The action also of the Christalline humour is assisted by the cobweb-like membrane which compasseth it about, for if you take out the christalline humor compassed with his Membrane and lay it vpon a written paper, the letters vnder it will appeare much greater then indeed they are, from whence haply came the inuention of Spectacles, and indeed this humour is a very spectacle to the Opticke nerue, gathering the species which fall vpon it and representing them in a larger forme vnto the nerue.

The christalline humor is a spectacle to the nerue.

Sight therefore is perfected and absolued, both by alteration and apprehension or discerning. The alteration is made in the Christalline by reason of the transparency thereof; yet is this transperencie of another kind then that of the watery humour, that it might bee both altered and also changed by the light. For that the impression might be more firme, it is thicker then the watery humour, that in the superficies thereof the sight might bee broken *ad perpendiculum*: for so the light is stronger vnited and corroborated when the beames are obliquely shed abroad and yet meete together againe into one because of their refraction; wherefore the Christalline humour is thicker then the other transluide bodies that are in the eye, as the horny membrane, the watery and glassy humours; because it was made not onely to returne and giue way to light and colours, but also to deteyne them, to suffer from them, and to receiue a sensation of visible things: for the thicknesse thereof prohibiteth the transition or vanishing away of the formes which are fixed in the superficies and body thereof. For sense is not made without passion or suffering: now it could not suffer vnlesse the action of the Agent had bene receiued vnto it. Notwithstanding, it is not so thicke or hard that the species or formes could not bee imprinted therein, but soft like vnto waxe and viscid that they might cleaue faster thereto. Hence it commeth to passe, that when a strong light, as that of the Sunne, beateth vpon the Christalline it is pained and offended, because the image of the light maketh a kinde of abode therein. But naturally the image of visible things are no longer retained in the Christalline then is necessary for their perception, but giue way to others: otherwise the sight would bee imperfect: for before the former images be vanished the succeeding cannot bee admitted, because the alteration remaineth in the Christalline vntil the representation acquit the place; when that is gone the alteration vanisheth together with it, and so there is way made for a new alteration.

How sight is perfected.

Why the christalline is thicke.

Why soft.

The conformation also of the Christalline helpeth much to make the sight perfect, for example. It is smooth and polished, that the formes therein might be most like to the bodies from which they are deduced. It is round that the light and the perpendicular beames thereof might in it be better vnited, and againe, that the light might be gathered in his superficies where the sensatiue facultie is the strongest, for so the formes euen of the greatest objects are conuayed whole vnto the Organe. Notwithstanding on the foreside this roundnesse is somewhat depressed, which depression helpeth much the reception of the formes.

The reason of the conformation of the christalline.

On

On the backside it is rounder than the light being brought vnto the Christalline might be vnited in it selfe and not disparted, but determine and subside in the glassy humor.

The reason of
his connexion.

The use of the
glassy humor.

The Christalline humor also before and behind is at liberty or free from connexion, that the light which entreth alway directly, might haue free passage through all the transluce bodies of the eyes, for by this meanes whatsoever is betwixt the Christalline humor and the thing seene is continuat by a continuity of transparency. Yet ought it not to bee on euery side loose, because then any extraordinary motion might haue violated the frame of the eye. Nature therefore hath hidde it in his circuite to the neighbour parts, and scituated it in the midst; that it might receiue the ministry of all the rest.

The glassy humor is seated after the Christalline, least if the light should haue passed on to the Net-like and Grapy Membranes which are coloured, it should haue returned againe to the cristalline defiled with those colours, and so the sight haue beene forestalled by those inward colours which are neere vnto it. Againe, at this *Diaphanum* of the glassy humor, there is a new refraction made of the light, not such a refraction as is in the Christalline whereby the light is more vnited, but because the substance of the glassy humor is more rare and thin, the light therein is dispersed and weakned, some say also vanisheth, others that it reacheth from thence into the cavity of the Opticke Nerue where the sight is perfected, and surely the finenes of the net-like Membrane is not able to returne the light that beatech against it, but rather giueth way thereto.

Galen credit
redemed by a
distinction.

How the chris-
talline is nour-
ished.

Another use of the Glassy humor saith *Galen* is to nourish the christalline, which it doth *per Diadosin* or transumption, for he thought that the christalline humor could be nourished by blood. But to saue *Galen*'s credit, we must heere distinguish, for all parts are nourished by blood; now the Christalline is a part and therefore it is nourished with blood. We answer, that it is not immediately nourished with blood but mediately, for because there are no Veines neyther in the christalline nor in the glassy humors (at least that the sight of man is able to apprehend) blood cannot be conuayed vnto them; neyther indeed ought it least it should haue infected the Christalline with a redde colour, which would haue beene a great hinderance to the sight, for it behoued aboue all things that the christalline should be free from all colour, because it was to receiue all. Wherefore it was necessary that his Aliment should bee prepared and not conuayed vnto him before it were fitted for his use.

The blood therefore conteyned in the Veines of the Grapy Membrane in which it is thicke and blackish is powred forth into lesser branches running through the Net-like Membrane, where it receiue an alteration becomming very thin and of a cleare ruddinesse, which blood is receiued by the glassy humor therein prepared and made a fit Aliment both for it selfe and for the christalline. Hence it is *Galen* saith, *The Glassy humor to the Christalline is like the stomacke to the Liuer.*

Diuers opini-
ons concerning
the nourish-
ment of the
christalline hu-
mor.
Galen's opini-
on.

But because Anatomists are of diuers opinions concerning the nourishment of the Christalline humor, it shall not be amisse to giue you a taste of euery mans apprehension in this matter, especially of those that are accounted Maisters in Anatomy.

Galen therefore in the first Chapter of his 10. Booke *de usu partium* saith, that the christalline humor is nourished by the glassy, and the glassy by that body which compasseth it about, to wit, the Net-like Membrane, and that *per Diadosin* or a transumption of matter, because (saith he) the christalline humor which is white, cleare and resplendent ought not to be nourished by blood, as whose qualities doe differ much one from the other, whereas the aliment should be familiar to that which is nourished thereby. Nature therefore prepared for it a proportionable aliment, to witte, the glassy humor, which glassy humor by how much it is thicker and whiter then blood, by so much doth the Christalline humor exceede it in humidity and whitnesse, for this christalline is exquisitely white and moderately hard.

Varolius.

Varolius enclineth to *Galen*'s opinion, his words are these or at least to this purpose. Euery thing is nourished by such a substance as determineth neere vnto that which it should nourish, and therefore the glassy humor is immediately placed behind the christalline, and is of a softer and a thinner consistence, also because so noble a part which needeth such abundance of spirits for continuall expence should not at any time be defrauded of nourishment, Nature made so great a quantity of the glassy humor; in which nutrition the Chrystalline turneth into his owne nature the thicker parts of the glassy humor because it is farre thicker and faster then it. But the thinner part of the glassy humor she separateth

as an vnprofitable excrement from the CrySTALLINE, and thereof maketh the watery humor. Thus far *Parolius*.

But saith *Archangelus* (who thinketh that the Christalline is so nourished with the glasse humor as a bone is nourished with the marrow) if the Christalline and glasse humours be parts of the body, then one part shall nourish another? But it may be answered, that there is a surplussage of the nourishment of the glassy humor which is a conuenient Aliment for the Christalline. Another question may be asked, saith hee, how *Galen* saith that in the glasse humor there is no veine? It is answered that there is no veine conspicuous, but yet there are very many which are so slender that the eye cannot discern them, and hence it is, that the glassy humor is not so white as the Christalline, because it is sprinkled with many blinde veines. In like manner in the white of the eye which is called *Tunica Adnata*, there appeare no veines at all, but if the eye bee inflamed, then many veines which before lay hid doe arise vp and become conspicuous. If the braine of a man be dissected, there appeare no veines therein, but if it be inflamed, then, saith *Archangelus*, may an infinite multitude be perceiued to run through his substance.

Archangelus.

Archangelus conceit.

Laurentius conceiue that the glassy humor is nourished by blood, and receiue small veines from the *Ciliar* or hayry crowne; and that the glassy humor prepares the blood for the Christalline, which blood it changeth least the purity of the Christalline should be infected, but he doth not thinke that the substance of the glassy humour is conuerted into the Christalline and assimilated thereto.

Laurentius

Aquapendens his opinion is, that the christalline is nourished by blood, and that as bones and membranes which are very white and farre remooued from the Nature of blood by a propriety of their temperament doe change the blood into their substance: so it commeth to passe in the christalline humor; and that the blood is conuayed out of the veines of the grapy into the net-like coate and there depurated that it might better be conuerted into the nitid and pure substance of these bodies. The thicker part is thrust downe into the grapy coate and there collected. The thinner part maketh the watery humor. Neither doth hee thinke it possible the christalline should be nourished by the glassy humor, *per Diadosin* or Transumption, because the cobweb-like membrane commeth betweene the two humours, which *Galen* was ignorant of, who thought that the forepart onely of the Christalline was couered, and from that mistaking fell into that error of nourishment by Transumption. And so much concerning the nourishment of the humors.

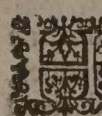
Aquapendens

Two other vses there remaine of the glassy humour, the one to retaine the spirits for the illustration of the Christalline, the other to defend it from the hardnesse of the membranes, and to make it a seat wherein it might securely rest it selfe.

Other vses of the glassy humor.

CHAP. XI.

Of the outward Eares.

 Auing thus absolued the history of the Eye, it followeth that we come vnto the organ of Hearing, which *Aristotle* calleth *Sensum disciplina*, because it was created for the vnderstanding of Arts & Sciences: for Speech because it is audible, becometh the Cause of that we learne thereby, as the Philosopher saith in the first Chap. of his Booke *de Sensu & sensili*. This instrument of Hearing is the Eare, framed by Nature with no lesse Art then the former. Yea so full of intricate Meanders is it, that it wil be very hard to be disciphered, so many and so small are the particles thereof, and couched so close in narrow distances or nookes betweene the bones. Notwithstanding wee will endeavour our selues for your satisfaction to acquaint you what we haue learned, as well by dissections as out of the writings of learned men, especially *Fallopins*, *Eustachius*, *Volcherus*, *Arantius*, *Aquapendens* and *Placentinus*. But in the pursuite of this so difficult a taske, we stand in neede and do implore the helpe of Almighty God, that he would set an edge vpon my wit, sayth *Bauhine*, to find out the miracles of his Creation, the Diuinity of his wisdom, and the infinite goodnesse wherewith he hath compassed vs on euery side. Moreouer, that he would giue me power perspicuously to propound and lay open to your capacities a thing so diuersly and quayntly folded vp, that the Eye is scarce able to follow the trayne thereof.

The history of the eares very difficult to expresse.

These instruments are called in Greeke, *ᾠτα & ᾠταρα*, in Latin *Aures ab hauriendis vocibus*, as saith *Lactantius*, in English, *Eares*, of hearing.

The names of the eares.

There are many parts of the Eares which serue as well for the reception of the sound into them, as also for the *intension* thereof. Some of them are such, as without which there is no reception of sounds, others are necessary for better reception and hearing. Finally, others were created for the conseruation of all the rest. We will diuide the Eare according to *Hippocrates in Coacis* into an outward and inward Eare, and first wee will entreate of the outward.

The reasons of
the name.

The Eares saith *Aristotle* are parts of the head by which we heare, and therefore it may be imagined they are called *Aures quasi aures, ab audiendo* from hearing. Instruments they are of Hearing indeed, as *Galen* confesseth in the second Chapter of his Booke *de Instrumento Odoratus*, but not the principall organs, because if the Eares be cut off close by the head, yet a man will heare notwithstanding, as if the nose bee cut off a man shall smell though imperfectly.

The reason is, because the principall instrument both of Hearing and of Smelling lies hid within the scull. The outward Eares therefore are helping causes, and when they are sound and whole they are of as great vse for the Hearing, as the nosethrills are for the Smelling.

These outward Eares properly called *Auriculae* are in men and beasts conspicuous, but in Birds and Fishes it is not so, for Birds haue onely holes whereby the sound entereth into their Braines, because their skin being harder they want matter whereof this Eare should be framed; beside, such eares as other creatures are furnished with, would haue beene a hinderance vnto them in their flight, as we see a contrary winde blowing vpon a saile stayeth the course of a Ship: as for Fishes no man that I know hath yet found out the instruments of their Hearing. Those holes which are placed before their eyes wee doubt whether they serue for Hearing or for Smelling.

What crea-
tures want
outward eares.

The outward Eares are placed in the same paralel or line with the eyes, yet not so much for the better reception of sounds, which saith *Cicero* in his second Booke *de Natura Deorum*, of their owne nature do ascend vward because they haue their consistence in the ayre; but rather from the commodity of those soft nerues within the scull which were to communicate the animall spirit disperfed through the substance of the Braine vnto the principall Organe of Hearing. Otherwise if the eares had their scituation onely for the apprehension of sounds, they might as well haue beene placed in any part of the Creature as where they are; because sounds are equally communicated to the whole ayre that compasseth vs about. But on the foreside they might not be placed, because that roome was to bee taken vp for the eyes and the instruments of other senses. For the Eyes, because we see by a right line; but we may heare as well on either side as directly forward, as *Aristotle* saith in the tenth Chapter of his second Booke *de Partibus Animalium*; although I am not ignorant that *Galen* in the eight Chapter of his tenth Booke *de vsu partium* is not altogether of *Aristotles* opinion.

The reason of
the situation
of the eares.

Againe for the Mouth, partly for the commoditie of receiuing meates and drinckes directly from the hand, partly also because it was fit wee should turne, not our eyes onely but our mouth also toward them with whom we discourse.

Thirdly for the Nose, that the saouours of meates and drinckes which we iudge and discern whither they be good or ill might more directly strike the sense of Smelling. Moreover, the Eares were not placed in the backpart of the head because there are no Nerues deriued thereunto; not in the top of the head least the couering of the Head should hinder the ingresse of the sound. It remaineth therefore that it was most conuenient they should be placed in the sides of the head or the face iust against the region of the eyes, and also be in man immouable. In brute beasts their scituation is somewhat otherwise, to wit, at the toppe of the Face, because their heads hang alwayes downeward vnto the earth to seeke their Food. In Beasts also the eares are moouable.

Apes Eares.

The Eares of Apes haue a middle position betwixt those of men and beasts, because it is a creature of a middle figure betwixt the erected frame of a man and the prone or bending posture of a beast. And as their position so likewise is their motion, not immouable as in Men, nor so moouable as in other beasts, but betwixt both.

Their Figure.

The figure of the outward eare is round or semi-circular [table 4. Figure 1. F, Table 5. fig. b b, Table 6. Figure 7. 1.] because that which is round is best secured from iniuries, as also most capacious. On the outside they are conuexe or gibbous. On the inside excauated like a denne

CHAP. 6.
Table 4. Fig.
muscle of the
Fig. 1. Sheweth

FIG.

Z. A muscle of
Fibres, e. the
saith 1. 1. C. 1.

den or corner
capacities, to b
be offered
only the sound
but also it is
ties till the ref
and harmonia
trouble or mo
more diffin
experience if v
gathered and m
cold Northern
ring is much in
shell, imagine
and directed v
The truth is
received in no
are cut away

Table 4. Fig. 1. Sheweth the skin of the head together with the fat, and the glandules under the eares and the muscles of the hinder part of the head and eares.

Fig. 2. Sheweth the muscles of the eares, of the eye-browes, and a few of the iawes.

TABVLA IIIII.

FIG. I.



FIG. II.



AA, The skin of the head together with the rootes of the eares.

BB, The muscle of the eare springing from the *Pericranium* or skul skin.

C, The triangular muscle moving the skinn of the nowle of the head.

DD, Branches of the externall iugular veine.

E, The tip of the eare.

F, The circumference of the eare called *Helix* in Greeke.

G, The glandules of the eares, in which is the disease called *Parotitis*.

The second Figure.

A, The semicircular muscle of the eare drawing the outward eare vpward, which was noted with *B*, in the first figure.

BCDEFG, the muscle as it were diuided into 3, parts called *Triparsitus*.

H, the hinder part of the outward eare, into which the foresaide muscle is fastened.

IIII, the circumference of the eare called the wing.

K, the lap or tip of the eare.

L, the little gristle on the outside of the hole of the hearing, which in ancient men is bearded, called *Tragus* because it is like a Goates beard.

MMM, the skull as yet couered with the *Pericranium* or skul skin.

NNN, the circumference of the temporall muscle.

O, the muscle yet couered with the *Pericranium*.

P, the membrane, couering the said muscle drawne aside.

QQQ, the fleshy part of the temporall muscle.

RR, the iugular or yoke bone.

SS, A sharpe proceffe of the lower iaw.

V, the muscle *masseter* or grinding muscle, remooued heere from the yoke bone whence it hath his originall, that the implantation of the temporall muscle into the proceffe of the iaw might appeare.

X, the muscles making the Cheeks.

Y, Fleshy Fibres going vnto the lips.

Z, A muscle of the lower lip. *aa*, the muscle of the eye-brow. *bb*, the vpper eye-lid hauing a muscle with transuerse Fibres. *c*, the eye brow hauing a circular muscle, whereby the externall parts of the eye are exceedingly constringed, as saith *Iulius Casserius Placen*.

den or cornered hole. Yet euen on the inside there are certaine swellings answerable to the cavities, to breake the violent rushing of the ayre or wind or whatsoever should vnawares be offered against them. For in these breaches of the eare as it were in hollow bodies, not only the sound of the ayre that rusheth in is readily and exactly drawne and fully receiued; but also it is broken and boundeth or reboundeth as a ball against the sides of the inequalities till the refraction get into the circular cavity and so the sound becomes more equall and harmoniacall. It attaineth also better vnto the Tympane or drum of the eare without trouble or molestation, and is imprinted vpon or into the inward ayre more strongly and more distinctly; and beside, by this meanes the sound continueth longer as wee may haue experience if we apply any hollow shell to our eares, for by that meanes the ayre is better gathered and more directly offered to the auditory nerue. The *Schythians* that liue in the cold Northernly countreyes haue often their eares rotted off with cold, whereby their hearing is much impaired to, amend which default they fasten about the hole some hollow shell; imagine it be of a great Cockle or Scallop wherein the ayre is concluded; gathered and directed vnto the head.

The truth hereof may be diuersly demonstrated, first because all sounds are most exactly receiued in hollow and hard bodies, as bells and such like. Againe, those men whose eares are cut away do receiue sounds and articulated voices after an obruse, dul or confused manner.

Ddd

ner

The reason thereof.

How the *Schythians* make amends for the r. ting of their eares.

ner like the fall of water or chirping of a Grashopper, inso much that the other eare which is not vitiated is notwithstanding impaired, vnlesse that which is wounded bee quite stopp vp.

Adrian the
Emperour.

Finally, such as are halfe deafe that they may heare the better, do set their hands to their eare with the palmes forward to gather in the sound, as we reade that *Adrian* the Emperour was wont to do. Another vse of this refraction of the aire is, least it should enter into the Eare too cold if it were not broken and beaten against the sides in the passage whereby it receiue if not heate yet a mitigation of his coldnesse. And finally, if it were not for these breaches many violent sounds would suddenly rush into the eare to the great offence of the Hearing.

The magnitude
of the Eares.

These Eares are not alwayes of one magnitude, but in some greater in some lesse, but most what proportionable to the magnitude of the body, and yet it hath beene obserued that where there is greater store of vitall heate there the eares are some what the larger. Howsoeuer, they are small in man in respect of other creatures, as well for ornament as because the head of a man (saith *Galen* in the 12. Chapter of his 11. Booke *De vsu partium*) was to be couered eyther with a hat or a head-peece or some other couering; wherefore if mens Eares had bene as bigge as beasts it would haue bene very inconuenient, yet they are large enough to cover the passage.

Why they are
two.

They are made double, not so much that when one is vitiated we might haue vse of the other (although this bee a great commoditie) as for the necessity and perfection of the Sense.

The diuision
of the outward
Eare.

The whole Eare which *Vesalius* not vnfitly compareth to a fanne wherewith they dresse Corne, may fitly be diuided into an vpper and a lower part. The vpper which is hard and as it were stretched *Aristotle* in the 11. Chap. of his first Booke *de historia animalium* leaueth without a name, but *Gaza* his interpreter calleth it *pinna* [tab. 4. fig. 1. tab. 5. b b] the Finne, as well because of the forme as also in respect of the vse: for the Forme, because that broad Gristle is not vnlike the Fin of a Fish: for the Vse, because as the fish guideth her selfe in the water with her Finnes, so these gristly parts cleaving to the sides of the head do guide the sound that it passe not away before it is communicated to the *Inward Aire*, and for the same cause it is called by some *πτερόγυμα*, that is, a wing; broad it is the better to entertaine or catch the sound which afterward descendeth by the inward compasse vnto the arched cavity that leadeth vnto the passage into the head.

The wing or
fin of the ears.

The Lappe of
the eare.

The lower part which is soft and depending [tab. 4. fig. 1. E fig. 2. K, tab. 5. fig. 1. a] is called *λαβός ἀπὸ τοῦ λαμβάνειν*, because we take hold of that when we wold admonish a man, and thence haply it was that the eare is consecrated to Memory. The Latines call it *Fibra*. *Tully* in his second Booke *ad Quintum fratrem* calls it *Ansa Auriculæ* the handle of the eare, we call it the Lap of the eare, because it is a softe and flexible body, hauing in it neyther bone to stiffen it, nor gristle to harden it, nor Nerve to stretch it, and therefore it may be perforated without paine or with very little, as we may see in young folkes of both Sexes, who vsually hang Jewels at it. *Laurentius* well obserued, that it is a signe of modestie or shamefastnesse, because vpon such a passion this part will grow redde. But the naturall vse of it is to conduct the excrements downward which yssue out of the eare.

The severall
parts of the
outward eare
and their de-
nominations.

The outward circumference of the eare is called *ἐλξ Capreolus* of the likenesse it hath to the writen Tendrill of a Vine. [tab. 4. fig. 1. F F. tab. 5. fig. 1. b b] The inner compasse, which is as it were opposite to the vtter, is called *ἀρτέλιξ*. *Pollux* calleth it *Scapha*, because it is somewhat like a Lighter or Barge. [tab. 5. fig. 1. CC] The great cavity which is compassed almost round by this inward circumference [tab. 5. fig. 1.] is called *Concha*, because it is like the shel of a Periwinkle and this is the principal part of the outward eare made so large that it might receiue all the sound which runnes within both Circumferences, but the cavity thereof groweth narrower toward the hole of hearing, that the sound being gathered into a narrower scantling might more suddainely and at once be offered vnto the Organ.

But the Cavity which is next vnto the hole of Hearing wherein the eare-wax is, is cald *αὐτίαν Aluearium*, & the bitter waxe it selfe *Αφροδίσαν* calls *αὐτίαν*. That eminence which is opposite to the hollownes [tab. 4. fig. 2. L, tab. 5. fig. 1. C] toward the temples which hangeth like a pent-house over the hole of the eare is called by *Ruffus* and *Pollux* *τράγος Hyrcus* the He-goate, because in this part there grow haire which in some men are so rigid and stiffe that they are like a Goats beard.

The part opposite hereto, to which the lap grows, sometimes is also hairy, [tab. 5. fig. 1. f] and

Tab. 10. sheweth the eares and the diuers internall parts thereof.

Figure 1. sheweth the whole externall eare, with a part of the Temple bone.

Figure 2. sheweth the left bone of the Temple diuided in the midst by the instrument of hearing, whereabout on either side there are certaine passages heere particularly described.

Figure 3, and 4. sheweth the three little Bones.

Fig. 5. sheweth a portion of the bone of the temples which is scene neere the hole of Hearing diuided through the midst, whereby the Nerves, Bones and Membranes may appeare as Vesalius conceiueth of them.

Fig. 6. sheweth the Vessels, Membranes, Bones and holes of the Organ of hearing, as Platerus hath described them.

Fig. 7, and 8. sheweth the little bones of the hearing of a man and of a Calf both ioyned and separated.

Figure 9. sheweth the Muscle found out by Aquapendens.

TABVLA X.

FIG. I.

III.



a. The lower eare or the lap of the eare.

bb. The circumference of the eare call'd in Greeke *Helix*.

cc. the interior protuberation or swelling of the eare call'd *Anthelix*.

d. The boate of the outward eare.

e. The Goats beard call'd *Tragus*, wherein are haire growing.

f. The place against the Goats beard call'd *Antitragus*.

Fig. 2. A, A part of the yoke bone.

B, The *Sinus* or bosome whereinto the lower iaw is articulated.

CC. The stony bone swelling within the Scall.

D, The second hole of the bone of the Temples for the passage of the sleepe Artery.

E, A little scale or thin bone betwixt this hole and the first cavity.

FFF. The porosity or sponginess of the stony bone.

aa. The externall hole of the eare.

bb. The bony canale of that passage.

c. The Tympane or Drumme is here placed at the passage.

d. The interior hole into which the nerue is inserted.

ef. Heere also is the stony bone perforated.

ggg. A canale of the auditory Nerue from e. to g. in the bone of the Temples, yet this Canale is described by it selfe at the side of the bone about the fift Figure.

aa. Two holes in the beginning and ending of this Canale.

γd. Two other holes in the externall and internall part.

b. The first cavity, according to some the second, reaching from e to E.

ii. Two canals or pipes of the first cavity.

k. The higher hole which is shut with the stirrop bone.

l. The lower hole alwayes open.

mm. The second cavity in the bone.

1, 2, 3. Three little barrows or holes of the second cavity p described apart.

n. The third cavity lying vnder this superficies.

Fig. 3, 4. o 3. A long bone representing a pyramidal Fig.

3, 4. The membrane of the drum.

q 3, 4. A bony ring at the tympane described also by it selfe.

r 4. The Mallet or Hammer.

J. The Anuile. z, the Stirrop. Fig. 5. A, A part of the hole of hearing. B, A membrane covering the hole ouerthwart.

C, The bone of hearing likened to a hammer. D, the auditory Nerue. G. His distribution through the great hole of hearing. E, A branch of this nerue going through a darke hole vnto the Temples. F. Another branch falling through the hole whereby a veine doth enter in. H I, A round cavity, in the fore-part whereof is placed, the bone noted with I.

Fig. 6. aa. the first hole of the Organe of hearing. β, the auditory Nerue diuided into two parts, where it passeth through the fourth hole. γ, The iugular veine with a part of a nerue passing through the first cavity. δ, Where it passeth through his second hole neere to δ. εε, An artery entering that cavity thorough the third hole, and a nerue falling through the same hole. H, the same artery falling through the fift hole. ii, the lower part of the fift Nerue reaching vnto the 2, and 3. cavity. θθ, A higher part of the fift Nerue brought through the scruiing canale or pipe vnto z, where it falleth out. x, the Tympane or Drumme shutting the first cavity. λ, the three little bones of hearing ioyned together. μ, the third cavity or the Trumpet of the organ of hearing. V, the second cavity or the mettall mine running out with three burroughs. ξξ, the Canale or water course carrying a Nerue and an artery, opening it selfe with two holes. Fig. 7, and 8. s, The Hammer.

σ, the Anuile. τ, the Stirrop.

and called *ἀντίπαγος*. The vse of both these is to forme the cavity and to hinder the sweat or any such like excrement or outward thing from falling into the eare. Betwixt these two there is a hollowed furrow like halfe a circle, which *Herophilus* calleth *ἐχμῆς* and *Pollux* *ἐχμίσχος*, into which the excrement or whatsoever yssueth out of the eare falleth before it get into the large cavity and so fall away by the lap.

The vse of
the outward
eare.

The vse of the whole outward Eare which like a Fan is dilated, was especially to intercept the species of sounds wandering through the aire, and to gather them as it were into a bosome, or if you will, into a broad tunnell to be conuayed by manifold breaches or returns to the hole of the Eare. Againe, the many oblique furrowes in the outward eare doe breake the violence & force of the ayre, which otherwise might haply loosen or breake the fine membrane of the Tympane or drumme. There are also certaine bunching protuberations where the gristle swels vp into a prominence, which prominence, if the aire doe passe the hole of hearing, beats it backe againe forward toward the cavity. For because the holes of the Ears are placed in the sides of the head, the sound may easily slip by them, especially when it commeth from behind vs and we moue forward, if it were not caught in these conuolutions and in the guttures of the gristly substance conueyed vnto the hole of hearing.

And hence it is that euen by instinct of nature we see brute beasts, as Dogges and Horses will pricke vp their eares, and partly turne them toward any sound or noyse that is made. And because the Eare might be thus prominent, as well in the parts as in the whole (for the whole eare standeth of a certaine distance from the head,) Nature hath made them of a Cartilaginious or gristly substance, which out of doubt would grow farther from the head if Nurseries or carefull mothers who haue more respect of comelinesse then of vse, did not bind them downe in our infancy.

A fitt simili-
tude expressing
how the sounds
come through
the aire vnto
the eare.

If you aske me how the sound of any thing farre off can ariue vnto the eare; I will answer by a pregnant example on this manner: If a stone be throwne into the midst of a pond, it moueth the water in circles, one alwayes succeeding greater then another vntill the motion determine in the brinckes or bounds of the pond: so in like manner those bodies which by their collision do make a sound, mooue the ayre into orbes or circles succeeding one another, so that the circles which are nearest to the body from whence the sound came are but small, the rest which follow them grow greater and greater vntill they come vnto the eare, whereat when they beate they are latched in those furrowes we spake of, and by them directed vnto the hole of hearing.

CHAP. XII.

Of the Parts of the outward Eares.

His outward Eare is made of parts, some common, some proper: the common parts are the cuticle, the skin, the fleshy membrane, flesh it selfe and a little fat in the lobe or lap. The proper parts are muscles, veines, Arteries Nerues & a gristle.

The cuticle or skarfe-skin we haue spoken of before in the second booke, as also of all the other common parts; onely of the skin it selfe in this part we may say, that it is exceeding thin, yet somewhat thicker in the gibbous or backside of the eare then it is in the concave or foreside, and the nearer it comes to the hole of hearing, the thinner it is. This skin compasseth the eare round about, both without and within, and cleaueth very strongly and firmly to a little flesh and to the gristle, that the superficies of the eare, especially the inner might be smooth and slicke, not corrugated or vnequall, as well for beautie and comelinesse as also for the better reception of sounds: for *Aristotle* in the 7. Probleme of the 11. section, enquiring why a house that is new plastered doth sound better then an old house? answereth, that the reason is, because the wals are smooth, which smoothnesse proceedeth from density or fastnesse. It is reasonable therefore to thinke that the smoothnesse of the eare helpeth the sound, and theretore the very hole also of hearing is inuested with a thigh, hard, thin and smooth skin, which cleaueth very closely to the membrane there vnder. But where the skin incompasseth the lobe or lap of the eare, it is so exquisitely mixed with the membrane and the flesh that it cannot be separated from them; and therefore we may call that part a fleshy, fatty and spongy skin.

The skin of
the outward
eare.
Aristotle.
Why a new
house sounds
more then an
old.

The veines of
the eares

The vessels of the eare are these. Veines of the eare *Hippocrates* tooke knowledge of, in his first Booke *de natura hominis*. Branches they are dispersed on eyther side [tab. 4. fig. 1. DDD]

Table 6. Figure 1. Sheweth the fore-face of the outward Eare without the skin.
 Figure 2. sheweth a ligament of the outward Eare whereby it is tyed to the Scull.
 Figure 3. The stony proceffe being broken sheweth the first cavity and the holes thereof.
 Figure 4, and 5. shew the Labyrinth, the snayly shell called Cochlea, two windowes and three semi-circles.

TABVLA VI.

FIG. I.



FIG. II.



FIG. III.



FIG. IV.



FIG. V.



Fig. 1, and 2.

AA, The outward eare depressed.
B, The hind part of the outward eare.
CCC, The circumscription of the whole ligament.
D, A part of the yoke-bone.
EEE, Parts of the scull.

Fig. 3, 4, and 5.

F 3, 4, 5, The Ouall hole or the window of the labyrinth, in the 4. figure it is broken.
G 3, 4, The window of the snayly shell or the winding hole.
H 3, the watercourse or darke hole betwixt the *Mammillary* proceffe and appendix called *Styloides*.
I 3, The *Mammillary* proceffe.
K 3, The cavity going vnto the *Mammillary* proceffe whose outward face is al spongy.
L 3, The interior face.
M 3, The knob of the nowle-bone of the necke.
P 3, the hole of the first payre of nerues of the internall *Iugular* veine, &c.
NNN 4, 5, The semicircles.
O 4, 5, The inner face of the snayly shell called *Cochlea*.

DDD] from the externall *Iugular* as also from the lesser branch of the internall *Iugular* veine which entreteth into the Basis of the scull through the fourth hole of the Temporall-bones. There is a small branch also directed to the Organ of Hearing and into the first cavity [tab. 3. lib. 7. fig. 13. n] which bringeth bloud for the nourishment of the parts containd, and haply also of the ingenite or in-bred ayre. And that there are veines deriued into this cavity, and vnto the membrane or drum, may be proued by the dissection of those bodies that dy of an inflammation of the braine or of the eares. For if the hole of hearing be featly opened, you shall find small veines conspicuous in the membrane or Tympane, which do not appeare when there is no inflammation, as we said lately it hapneth in the white of the eye.

Arteries it hath from the inner branch of the *Carotis* or sleepy Artery which passe to the backside of the Eare [tab. 13. lib. 6. O] that those parts and the in-bred ayre also might be refreshed with vitall bloud and spirits.

Two small nerues it hath from the backward, and two from the sides of the second coniugation of the marrow of the necke; and these are very small, sayeth *Galen* in the 6. Chap. of his 16. Booke *De usu partium*, in Men and Apes, because their temporall muscles bee very small, and the substance of their eares is immoueable: but in other creatures sayth he, whose temporall muscles and eares are very large, these nerues also are large, because of the strength required to those motions. The vse of them in men is to bring Sense to the eares

The arteries of the eare.

The nerues.

eares and sometimes to moue the muscles, for those muscles are not alwayes found.

CHAP. XIII.

Of the Muscles of the outward Eare.



Ens Eares are for the most part immoueable, yet they may be moued, as appeareth as wel by their muscles as also by the nerues which as we said euen now, are found in some bodies. But the muscles are so small and the nerues so threddy that their motion is hardly perceiued: and Nature made them small because too much motion would haue vitiated the hearing, & therfore the head is rather made to moue speedily on euery side toward the sound or voice, which is not so in beasts whose eares are moueable.

Such as they are *Falopius* first found them out, and therefore the honour of their Invention belongeth to him. They are of two sorts, Common and Proper.

The first is common to the Eare and both the Lips, and is a portion of that muscle which is accounted the first of those which moue the cheeks and the skin of the face, and is called *Quadratus* [tab. 7. fig. 1. L] The square muscle; it is inserted with ascending fibres into the roote of the eare. [tab. 6. fig. 1. O]

The second is a proper muscle [tab. 7. fig. 1. neare B, tab. 4. B B, fig. 2. A] seated in the fore-part vpon the temporall muscle, and ariseth from the vpper end of the muscle of the forehead, and is inserted into the vpper part of the eare.

Table 7. Figure 1. Sheweth the muscles of the Fore-head, the Eye-lids, and the Cheeks.

Figure 2. sheweth the muscles of the Nose, Lips, the lower Iaw and of the bone Hyois.

TABVLA VII.

FIG. I.



FIG. II.



A 1, 2, The muscle of the fore-head and the right fibres thereof.

B 1, 2, The temporall muscle.

a B γ 2, His semicircular originall.

CE 1, The first muscle of the Eye-lid compassing the whole lid.

FD 1, The third muscle of the wing of the nose which endeth into the vpper lip.

GH 1, The muscle of the vpper lip.

G 2, The place of the yoke bone without flesh.

I 1, the broad Mouse-muscle stretched ouer the cheeks and all the lower parts.

δ ε ζ θ, the circumscription or circumference of this muscle.

I 1, the yoke-bone.

I 2, the grinding muscle or the second muscle of the Iaw.

The forward K, in the second figure sheweth the higher gristle of the nose.

L 2, the wing of the nose.

M 2, A muscle forming the cheeks.

N 2, the muscle of the lower lip.

O 2, A part of the fifth muscle of the lower iaw called *Diagastri-*

cus, that is, double bellied:

P 2, the bone *hyois* is set in this place.

QR 2, the first muscle of the bone *hyois* growing to the Rough artery.

S 2, the second muscle of the bone *hyois* vnder the chin.

The lower T, in the second figure sheweth the third muscle of the bone *hyois* stretched to the iaw; the vpper T, in the second figure sheweth the insertion of the head.

VV 2, two venters of the fourth muscle of the bone *Hyois*.

the backward K, (put in stead of X) sheweth the seauenth muscle of the head and his insertion at the vpper T.

α A 2, the originall of the grinding muscle from the yoke-bone.

μ 2, the insertion of this muscle into the lower iaw. γ 2, A small nerue running to the forehead out of the orbe of the cies.

π 2, A nerue propagated to the face. ρ σ 2, two beginnings of the seauenth muscle of the head. T 2, His insertion into the *Mammillary* proceffe.

υ 2, the clauicle or the collar-bone. φ 2, A place where the vessels attayning to the head and the nerues of the arme do passe through.

The

The third [*tab. 7. fig. 1. neare O*] ariseth from the nowle above the *Mammillary* proceffe, where the muscles that moue the head and the shoulderblade do end, & is implanted on the backside of the eare.

The fourth proceedeth from the same *Mammillary* proceffe vnder the ligament of the gristle of the eare, and is inserted into the whole roote of the eares gristle. [*tab. 4. fig. 2. H.*] One part of it above, another part in the middest, and the third below. The more exact description of these muscles we referre vnto the Booke of muscles.

CHAP. XIV.

Of the Gristle of the Eare.

H He substance of the outward Eare is neither bony nor fleshy [*the interior face of the Eare slayed is exhibited in the first Fig. of the sixth Tab.*] but of a middle nature betwixt both, for if it had bene bony it must haue bene of a thin bone or a thicke. If it had bene made of a thin bone, saith *Aristotle* in the 9. Chap. of his second Book *de part. Animal.* then would it easily haue bene broken. If it had bene made of a thicke and solide bone, it

Table 8. Figure 1. Sheweth the fore-face of the outward Eare without the skin.

Figure 2. sheweth a ligament of the outward Eare whereby it is tyed to the Scull.

Figure 3. The stony proceffe being broken sheweth the first cavity and the holes thereof.

Figure 4, and 5. shew the Labyrinth, the snayly shell called Cochlea, two windowes and three semicircles.

TABVLA VIII.

FIG. I.



FIG. II.

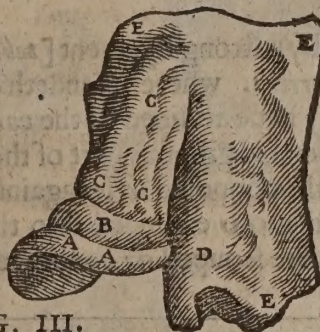


FIG. III.

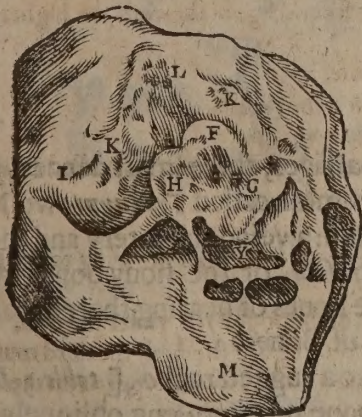


FIG. IV.



FIG. V.



Fig. 1, and 2.

- A A*, The outward eare depressed.
B, The hind part of the outward eare.
C C C, The circumscription of the whole ligament.
D, A part of the yoke-bone.
E E E, Parts of the scull.

Fig. 3, 4, and 5.

- F 3, 4, 5*, The Ouall hole or the window of the labyrinth, in the 4. figure it is broken.
G 3, 4, The window of the snayly shell or the winding hole.
H 3, the watercourse or darke hole betwixt the *Mammillary* proceffe and appendix called *Styloides*.
I 3, The *Mammillary* proceffe.
K 3, The cavity going vnto the *Mammillary* proceffe whose outward face is al spongy.
L 3, The interior face.
M 3, The knub of the nowle-bone of the necke.
V 3, the hole of the first payre of nerues of the internall *Inguilar* veine. &c.
N N N 4, 5, The semicircles.
O 4, 5, The inner face of the snayly shell called *Cochlea*.

would

would haue beene a burthen to the head, and beside would not haue yeelded to outward occurrents. Againe, if it had beene as soft as flesh it would haue fallen into it selfe and haue been vnterly vnfit to haue made those cavitie, protuberations, furrows and such like which in the eare are very necessary: neither would it haue receiued the sound which must be returned from a hard body, and so the ingresse of the ayre would haue bene hindered.

Why moderately soft.

It was made therefore of a substance moderately soft and moderately hard, that by reason of the softnesse it might be bent on euery side and giue way to the opposition of whatsoever doeth light against it, that so it might not bee subiect to contusion nor breaking. Againe, the moderate hardnesse thereof makes it fitter to be stretched, to stand vpright, to be alwayes open, that the ayre together with the sound might euermore gather into it; for saith *Cicero* in his second Book *de natura Deorum*, when we are asleepe we haue need of this sense that we might be awaked. Moreouer, the hardnes makes it fit to receiue the cavitie and furrowes which are therein, whereby the sounds are retayned that they passe not the hole of hearing. Yea whilest the sound runneth through those cavitie, *Aristotle* saith, it gathereth strength, and by the refraction is after a sort modulated or tuned, and so cometh more welcome to the tympane.

Why moderately hard.

Finally, because it is moderately hard it yeeldeth also a sound and so the voyce or noyse is better receiued, and as it were formed without any eccho or singing, or other noyse like the fall of waters which happeneth to those *Scythians* of whome wee made mention euen now, who when their eares rotted off doe apply hollow shelles of Scallops or such like behind the holes of their eares.

The originall of the cartilage.

Wherefore it consisteth of one gristle [*tab. 4, fig. 1.*] and that flexible, couered ouer with a thin skin which cleauerth close vnto it. This gristle proceedeth as it were out of the temples and standeth aloofe from them more or lesse. For the first originall of this grytle is from the orbe [*tab. 3, lib. 7, fig. 9. y*] of the hole of hearing which is boared in the temple bone and exasperated or made rough in the circumference that the gristle might better arise therefrom. At the very originall it is thicker and harder; thicke that the roote thereof might be more firme, and harder because of the neighbourhood of the temple bone from whence it proceedeth; and by how much it standeth further off from the bone of the head by somuch it becometh the softer and the thinner.

The ligament

This gristle is also tyed to the stony bone by a strong ligament [*tab. 8, fig. 2. C C C*] which ariseth with many propagations from the *Pericra*. where it tendeth toward the mammillary processe. These propagations when they haue attained to the eare, doe all ioyne into one ligament, which is inserted into the vpper and gibbous part of the eare, to suspend or hang the gristle streight vpward. This gristle is opposed or set against the hole of hearing that the passage thereof might be larger and more extended into the hollownesse of the gristle, by which meanes the sound is as it were scouped or swallowed vp.

CHAP. XV.

Of the inward Eare.

The parts of the inward eare.

THe inward Eare hath many parts, five holes or passages, three small dennes, small bones as many; the Membrane or head of the drumme called *Typanum*; two Muskles; a Nerue from the fourth and fifth coniugation: a veine and artery and the Inbred Ayre. All which are containd in one called *Os petrosum*, or the stony bone, whose description we will here prosecute at large, because of the bones of hearing therein contained, and make but slender mention thereof in our booke of Bones.

The rockie or stony bone.

This stony bone so called, saith *Vesalius*, because it is like a rugged rocke, [*table 3, lib. 7, fig. 9. f. 2*] is the third and interior processe of the temple bone running along obliquely forward from the hole of the eare, betwixt the Mammillary processe and the processe of the yoke bone, and buncheth out in the inner basis of the skull, [*tab. 9, fig. 2. from a P toward C, & beyond*] betwixt the wedge bone & the nowle bone, so that it is much more conspicuous in the inside of the scull then it is on the outside. This processe is some-what round, the better to containe a greater quantity of inbred aire: long also, somewhat like the ridge of a rocke, and that because the nerue of hearing (which is the softest of all nerues except the Opticks) might run his long course from the braine without danger of beaking.

Where

Tab. 10. sheweth the eares and the diuers internal parts thereof.

Figure 1. sheweth the whole external eare, with a part of the Temple bone.

Figure 2. sheweth the left bone of the Temple diuided in the middest by the instrument of hearing, whereabout on either side there are certaine passages heere particularly described.

Figure 3, and 4. sheweth the three little Bones.

Figure 5. sheweth a portion of the bone of the temples which is scene neere the hole of Hearing diuided through the middest, whereby the Nerues, Bones and Membranes may appeare as Vesalius conceiuech of them.

Figure 6. sheweth the Vessels, Membranes, Bones and holes of the Organ of hearing, as Platerus hath described them.

Figure 7, and 8. sheweth the little bones of the hearing of a man and of a Calf both ioyned and separated.

Figure 9. sheweth the Muscle found out by Aquapendens.

TABVLA X.

FIG. I.

III.



- a. The lower eare or the lap of the eare.
 bb. The circumference of the eare call'd in Greeke *Helix*.
 cc. the interior protuberation or swelling of the eare call'd *Anthelix*.
 d. The boate of the outward eare.
 e. The Goates beard call'd *Tragus*, wherein are haire growing.
 f. The place against the Goats beard call'd *Antitragus*.
 Fig. 2. A, A part of the yoke bone.
 B, The *Sinus* or bosome whereinto the lower iaw is articulated.
 CC. The stony bone swelling within the Scall.
 D, The second hole of the bone of the Temples for the passage of the sleepe Artery.
 E, A little scale or thin bone betwixt this hole and the first cavity.
 FFF. The porosity or sponginess of the stony bone.
 aa. The external hole of the eare.
 bb. The bony canale of that passage.
 c. The Tympane or Drumme is here placed at the passage.
 d. The interior hole into which the nerue is inserted.
 ef. Heere also is the stony bone perforated.
 ggg. A canale of the auditory Nerue from e, to g. in the bone of the Temples, yet this Canale is described by it selfe at the side of the bone aboue the fift Figure.
 aa. Two holes in the beginning and ending of this Canale.
 γd. Two other holes in the external and internal part.
 h. The first cavity, according to some the second, reaching from c to E.
 ii. Two canals or pipes of the first cavity.
 k. The higher hole which is shut with the stirrop bone.
 l. The lower hole alwayes open.
 mm. The second cavity in the bone.
 1, 2, 3. Three little burrows or holes of the second cavity p. described apart.
 n. The third cavity lying vnder this superficies.
 Fig. 3, 4. o3. A long bone representing a pyramidal Fig.
 3, 4. The membrane of the drum.
 q3, 4. A bony ring at the tympane described also by it selfe.
 r4. The Mallet or Hammer.

J. The Anuile. i, the Stirrop. Fig. 5. A, A part of the hole of hearing. B, A membrane covering the hole ouerthwart.
 C, The bone of hearing likened to a hammer. D, the auditory Nerue. G, His distribution through the great hole of hearing.
 E, A branch of this nerue going through a darke hole vnto the Temples. F, Another branch falling through the ring.
 H, A round cavity, in the fore-part whereof is placed, the bone noted with I. hole whereby a veine doth enter in. HI, A round cavity, in the fore-part whereof is placed, the bone noted with I. hole whereby a veine doth enter in.
 Fig. 6. aa, the first hole of the Organe of hearing. β, the auditory Nerue diuided into two parts, where it passeth through the fourth hole. γ, The iugular veine with a part of a nerue passing through the third hole, and a nerue falling through the same hole.
 H, the same artery falling through the fift hole. ii, the lower part of the fift Nerue reaching vnto the 2, and 3. cavity. θθ, A higher part of the fift Nerue brought through the scruiug canale or pipe vnto i, where it falleth out. u, the Tympane or Drumme shutting the first cavity. x, the three little bones of hearing ioyned together. u, the third cavity or the Trumpet of the organ of hearing. V, the second cavity or the mettall mine running out with three burroughs. ξω, the Canale or water course carrying a Nerue and an artery, opening it selfe with two holes. Fig. 7, and 8. ς, The Hammer. σ, the Anuile. τ, the Stirrop.

Wherefore the production of this bone is inward to receive the nerve as soone as it yssueth out of the *Cerebellum* or After-braine. Another reason why this production is lengthned, is because it might make a fit channell or furrow wherein to carry a branch of the *Jugular* veine or sleepey artery to the braine.]

But there where it yssueth out of the Temple-bone it is broader and thicker, that those turnings and cavities which were necessary for the Sense of Hearing might bee better insculped or wrought therein; yet as it proceedeth forward it endeth by degrees into a sharp Cone or point where the veine or artery entreth into the braine, and so the whole processe is like a *Pyramis* or spire. [tab. 9. fig. 3. o.]

The names of it.

How it is found in children.

The parts of it
The outside.

The perforations of the rocky bone.

Within the skull two.

The first.

The second.

This bone is exceeding hard for the security of the Organe of Hearing, and harder indeed than any bone of the body, whereupon it is called *Os Petrosum* or *Lapidosum*, the Rocky or Stony bone. Some use to call the temple-bones *Lapidosa*, and they call this bone *the interior processe of the stony-bone*. In Infants it is called *Os labyrinthi*, the bone of the Labyrinth, in whome it is separated from the temple bones (as also in a Calves head it will easily fall from them when it is sodden) and wanteth the halfe of that passage, which maketh *the hole of Hearing* in growne bodies. For this hole in Infants is altogether gristly and in dissections found distinct from the rocky bone: and therefore because it is without that passage we may in Infants perceive without breaking the bone, the *Timpane* as wel the membrane or head of it, as also the bony circle to which the membrane is fastened: but as the body increaseth and the gristly parts grow dry, they turne into bones even the hole of hearing it selfe; and so the rocky bone groweth very fast to the scaly part of the Temple bone vnder which it lieth, and becommeth as it were a processe thereof.

In describing this bone, we must consider his outside and his inside. His outside as it appeareth either within the scull or without the scull. The outside within the cavity of the scull is couered over with a hard and strong crust, as hard as is the substance of the teeth. The superficies thereof is smooth, not rough as it is without the scull but yet vnequall; because in the middle of the length thereof it buncheth out by reason of the *bones of Hearing* which in that place are contained; [Table 9, Figure 2, betwixt n and the lower E] so also in the vpper part there runneth a sharp and rough line through his length whereby it is diuided into two sides, and forward it endeth into a rough sharpnesse. [Table 9. Figure 2. from F toward d]

It hath many perforations that the ayre hauing receiued as it were the stampe or impression of sounds might passe through them vnto the instrument of Hearing. These perforations are of two sorts, some within the scull some without; within the scull there are two; one is a large and patent hole in the face of the processe which looketh backward, [tab. 4. lib. 7. fig. 10. a, tab. 9. fig. 2. from d to l] and this hole reacheth obliquely outward almost to the very middest of the processe: it is smooth and round in the ingresse, but dilated afterward by degrees as it were into two parts, whereinto the nerve of Hearing is implanted. This hole *Platerus* accounteth to be the sixt of the Temple bones, and the fourth hole of Hearing. But we shall account it for the seauenth hole of the Temples.

This cavity in the bones of Children is shorter, and beareth the forme of a hollowed denne or of a porch. But in growne men when the bone is increased that forme perisheth and it receiveth the figure of a fistulated hole or winding burrough; presently after the ingresse of which burrough (as may be perceiued in the scull without dissection) may be found two holes in the bottome of the entrance which goe into two bosomes or pipes, the one vpperward the other downward [tab. 9. fig. 2. e f] into which the nerve is deuided and through them conuayed. The one hole or pipe is higher and runneth more manifestly toward the vpper part of the hole of Hearing, passing obliquely outward to the inner part of the processe, and so into that canale or pipe which is called *Aqueductus* or the Water-course. [tab. 8. fig. 3. H]

It is distinguished or parted from the second and third cavities onely by a thin scale, and leadeth along the greater part of the nerve [tab. 9. fig. 2. e] of which we shall speake in the first cavity.

The other hole or pipe is lower and lesser, sometimes single sometimes double, appearing in the inside of the passage, and leading along smal furcles of the nerve into the second and third cavities. [tab. 9. fig. 2. f]

The other hole of the stony bone within the scull which *Platerus* calleth the seauenth hole of the Temples and the fift of Hearing, [table 9. figure 2. y] is in the foreside of the processe, narrow

narrow and rough like a ragged cleft through which a small artery passeth from the Organe of hearing vnto the scull : we will account this hole for the eight of the Temple bones.

The holes of the stony bone without the scull are three. The first (which we account for the first hole of the Temples runs into the hole of hearing, [tab. 3. lib. 7. fig. 9, 7, tab. 9. fig. 2. a a] which is called *σφηνοειδης meatus auditorius*. This hole, because of the gristle which is extended and stretched about the beginning thereof, hath a large and ample orifice resembling a caue or den, and it runneth betwixt the mammillary proceffe, and a part of the Jugall or yoke bone.

Without the
skull.
The hole of
hearing.

In yong children, saith *Coiter*, it is all gristly, in those that are growne it is but halfe gristly & halfe bony. The gristly part groweth out of the gristle of the eare: the bony out of the bony circle of the Temple bone. For in the first conformation it is like a bony ring distinguished from the Temple bone by a cartilage comming betweene them, from which cartilage ariseth the membrane of the Tympane or head of the drumme: and this may be perceived in the skulles of infants new borne till they be fixe or seauen months old if they bee boyled; but afterwards this gristle is dried vp and vtterly obliterated, and the bony ring or circle, of which we shall speake in the next chapter, is no more distinguished from the hole of hearing but vnited to the rest of the bone and streightned a little, making a long & round bony canal or pipe [tab. 9. fig. 2. ll] wherein to receiue a greater quantity of ayre, and also that the passage might be more patent and open vnto any sound: which canale runneth inward to the head of the drumme, [tab. 9. fig. 2. from e to c] and that obliquely vpward, or if you will describe the progresse thereof from within forth, then say, that it slopeth a little downeward, and from behind runneth something obliquely forward into the outward eare, where it becommeth somewhat more ample and large.

This passage therefore is oblique and winding to breake the vehement appulsion, or rushing in of cold ayre, that it should not dissolue the harmony of the Tympane and nerue of hearing. Againe, that a strong sound before it affect the Tympane might be communicated to the *internall ayre* and to the nerue; or be broken and so touch the membrane gently and without violence, for a slope blow offendeth lesse then that which commeth in a streight line, and yet for all this we see often times that the noyse of great Ordinance or of Bels, if a man be in the steeple, yea an intollerable cold ayer doe affect the Eare with paine and dolour; sometimes also breake the Tympane from whence deafnesse followeth.

The forme of
the hole of
hearing.

This passage also runneth obliquely from behind forward and vpward, lest those things that fall outwardly vpon the eare should easily bee admitted into the cavity, as also if any thing haue by chance insinuated it selfe that it might with greater facility fall forth againe. It is by degrees streightned or becommeth narrow; first that the ayer being beaten might be gathered into a narrow compasse, by which our hearing is farre more distinct. Againe, that if any small creatures should get into the entrance of the cavity, yet the streightnesse thereof in the bottome might stay their course or returne them backe againe.

The like also we may say of crummes, of pease, or of any such thing that should happen to fall into the eare. There is also in this place a bilious viscid and bitter humor wherewith, saith *Cicero* in second Booke *de natura Deorum*, as with lime such creatures are intangled. Wherefore also there are haire growing in those particles of the eare which before we called *Tragus* and *Antitragus* resembling the beard of a Goate.

This hole also is solide and hard, for by that meanes the sound in the passage beeing stronger beaten against the bony or hard sides of the passage is so much the more intended then if it had bene more membranous or soft. It is also inuested or couered with skin, partly to breake the sound which would haue bene more vehement if it had beaten against a naked bone: partly also lest the bone should haue bene corrupted or tainted by the ayer: wherefore it is hard, thicke, polished and strongly ioyned to the bone.

The substance
of it.

Finally, this passage in the beginning and the end hath certaine circles, the outward of which is rough, [tab. 9. fig. 2. b] because of the gristle of the eare which groweth thereto: to the inner circle the small membrane of the Tympane or the drumme-head is stretched and tyed. [tab. 9. fig. 2. c]

The primarie vse of this hole or passage is, that the ayer altered by the sound, might through it be deriued vnto the eare, and so through the concauity thereof might insinuate it selfe from the backpart obliquely foreward to the membrane of the Tympane; for through narrow, concauous, smooth and hard passages, sounds are commonly carryed, not onely with more ease, but also do more exquisitely represent the nature of the sound. And

The vse of it.

this

this shall he easily perceiue that will strike a trunke very gently at one end, so that hee that standeth by him may not heare it; and yet if a man lay his eare to the backe end of the trunk he shall easily heare how often the fore end is striken; because in the trunk as in a narrow place the ayre is condensed and by that meanes the sound vnited and sharpned; whereas if the ayre that is beaten by the sounding body shall passe thorough a large place, it will bee diffused and dissipated and loose much of his strength.

The second.

The secondary vse of this hole of hearing is for the expurgation of the chollericke excrement of the braine, (for phlegme is rarely purged this way because of his thicknesse) which through the veines attaineth to the membrane of the Tympane & through it sweateth into the hole of Hearing. In this hole also we finde a muscle of which we shal speake after ward.

Another perforation.

There is another hole which we account to be the third hole of the Temple-bone [table 3. lib. 7. fig. 9. V] scituated neare the first hole of the wedge-bone, and is a great deale narrower then the former. It is oblique, short and double, and admitteth a branch of the Angular veine; emitteth also or sendeth out a small branch of the nerue of Hearing.

CHAP. XVI.

Of the Canale out of the Eare into the mouth.



He third outward hole of the Stony-bone which we account for the fift hole of the Temple-bone [tab. 3. lib. 7. fig. 9. s] is scituated betwixt the Mammillary proceffe and the appendixe called *Styloides*, and endeth into a hole or canale which passeth from the eare into the mouth. Of this passage *Aristotle* made mention, but *Eustachius* was the first that described it, and after him *Volcherus Coiter*. This hole or passage is like a round pipe or small quill, larger in the beginning and passeth obliquely to the inward and foreside of the Basis of the braine, and in the midst of foure holes it penetrateth the whole bone where it is encreased by a substance that is partly gristly and partly membranous. But before we prosecute this passage further, we will shew you those foure holes in the midst of which this passage thorough the bone is.

where it perforateth the bone.

The first therefore is on the backside where the sleepey artery entreteth into the skull. The second is on the foreside through which the fourth coniugation of nerues yssueth out of the skull. The third at the outside making way for the artery which is to be distributed into the *Dura meninx*. The fourth at the inside is a fissure made of the extremities of the wedge and stony bones, passing obliquely downeward and forward. And in the very midst of these perforations doth this cavity pierce through the bone.

The substance of it.

Now to return vnto the substance. We said before that it was partly gristly, partly membranous. For at the last of the 4. holes or the fissure which is common to the wedge and the Temple bones the substance of it is gristly and very thick. But on the opposite part it is not exactly gristly but as it were membranous & becommeth thinner. This canale thus encreased with substance of another kind passeth between two muscles of the throate as the forenamed fissure passeth and neare the root of those proceffes which we likned to Bats wings, on the inside, I say, of them it determineth into one of the cavities of the nostrils, and is inserted into the thicke coate of the Palat neare the roote of the *Vuula*. But the inward extremity or end of this passage where it respecteth the middle cavity of the nostrils becommeth a strong gristle bunching or swelling much outward, which is couered with the mucous or slimy coate of the nose, and ser as a Porter to keep the end or outlet of the passage.

The figure of it.

The figure of it is not round but a little depressed making 2. angles, the hollownes thereof is much about the proportion of a goose quill, yet so that it is twice as broad in the end as it is in the beginning, and is likewise couered with a mucous coate, but that thin.

Why gristly.

It was made gristly that the way might be alwayes open and that it should not hurt the neighbour parts with his hardnesse, but easily yeeld without danger of breaking. Moreover, it was couered with a mucous or slimy coate, which *Laurentius* compareth to a value such as groweth within the veines as we shall vnderstand hereafter: the vse of which coate is to couer the orifice of this passage within the mouth, that euill vapours might not exhale out of the mouth into the eares. The termination of this passage is on both sides common to the nosethrilles, the pallate and the canale it selfe, that by this meanes the mouth might be a fit receptacle for all the kindes of excrements of the braine; and (which sheweth the wonderful prouidence and wisdom of Nature or rather of the God thereof) the

Where it determines in the mouth.

the very end of it is where the muscle of the chops is situate, that so when vpon our swallowing the chops are dilated or opened by the muscle, this passage also is recluded or opened to giue way to the descending excrement.

The chiefe vse therefore of this passage is for expurgation, to leade along the superfluities that fall from the head, by the eare into the mouth, as also to purge and depurate that ayre which is implanted in the instrument of hearing; for it was necessary that many excrements should in this place be gathered together, because the braine lyeth about it which yeeldeth much excrement: and we may well conceiue that many of those excrements are gathered together about the eare, by the quantity that issueth sometimes outward through the hole of hearing.

The chiefe vse of it.

An honest man of good credit told mee that hee had beene deafe three or foure yeres, at length his eare was cleansed by one that professed some skill in curing deafnesse, and that in two dayes he drew out of his eare the quantity of two great Wall-nut shels full of wax, and that therupon hee instantly recouered his hearing againe. If therefore there were so many thin excrements which could sweate through the fast membrane of the tympane, what a multitude shall wee imagine may lurke within, which for their thicknesse cannot possiblie sweate through?

A Rorie.

Aquapendens also testifieth, that hee had often obserued these inward cavities especially in children to be full of a thicke humor, slimy and mucous, which ought to haue beene purged away by this canale or passage: otherwise if it stay within, either it altogether stoppeth vp the eare, or else being resolved by inward heat is converted into wind, from whence come those singing noises and murmurs of the eares, and consequently the deprauation or vtter amission and losse of hearing.

Hence therefore we may obserue, that in inward offences of the eares, it is a very reasonable course for the Physician to prescribe *Masticatories*, because the wayes are open, eyther for Nature to expell being prouoked, or for the Medicine to draw euen crasse and thicke matter by this waie into the mouth. Beside by this meanes the passage shall bee kept drie and the drier it is the more fit to receiue sounds. And hence it is, that *Hippocrates* in the seventeenth Aphorisme of the third Section saith, that the North winde because it is dry makes a man heare the better, and on the contrary, the South winde which is moyst, duls and offends the eare.

The vse of Masticatories in deafnesse.

Another vse of this Canale is for the behoofe of the *Inbred aire* of the eare: first, to purge it and make it clearer, drier & thinner: againe to restore it and refresh it, for it is not to be doubted but that new aire is supplied out of the mouth by this passage. For considering that the *Ingenit aire* is perpetually wasted by the inbred heate, it is agreeable to the wisdom of Nature that it should be supplied by a regeneration of new aire which must be made of externall aire, because the ingenite aire was at the first made of externall. Furthermore, that the aire doth passe out of the mouth into the eares, we are taught both by *Aristotle* in the eleuenth Chapter of the first Booke of his History of Creatures, and also by experience, because when a man yawne wide he cannot heare what is spoken, and beside he perceiueth a noyse in his eares. In like manner, when a man blowes his nose or with any force containes his breath, he shall euer perceiue that the aire entereth into his eares, and with a certaine perturbation whereby the implanted ayre is disturbed, because it is a drift not without some violence or constraint; but when the ayre insinuateth it selfe of it owne accord for the refection of that which is bredde in the eare, then is the motion gentle so that wee doe not perceiue it. And beside the length of the passage prepareth and fitteth the newe ayre for the refection and nourishment of the old. Wee may also imagine that by reason of this passage, *Alcmeon* of whome *Aristotle* maketh mention in the place aboue quored, did thinke that Goates drew their breath not onely by their mouths and by their Nofethrils, but also by their eares, which wee haue no great Reason to thinke strange, because wee see that cunning Tobacconists (a generation of new and addle Artistes) can driue the smoake out of their mouthes thorough their eares.

The 2. vse of the Canales.

A third vse of this canale is, that if it happen the sound cannot directly passe vnto the Nerue of Hearing by the hole of the eare, that then at least some of it might this waie through the mouth bee conueyed vnto the organ of Hearing, and so those that are deafe dy outward accident might receiue the sound or voyce by the mouths. And this wee may verie well discerne by the receipt of the sound or a Muscical Instrument. For if a man stoppe both his eares verie close and hold a wand in his mouth, the other end whereof doth touch

The third vse.

How a deafe man may bee made to hear.

any instrument that is plaid vpon, hee that so holdeth the wand in his mouth shall bee able to discern the Musicke. In like manner if in the night time you be desirous to know whether any man be comming toward you, set a staffe vpon the ground or but a sword, and hold the end or pommel betwixt your teeth, and you shall heare a great way further off then your outward eare will be able to discern especially if the way be stony.

The fourth
Use.

A fourth use of this canale is, that in a vehement and violent noyse such as the shooting of ordnance, thunder and such like is, the membrane of the tympane or head of the drum might be secured from breaking, for surely it would bee in great danger to breake if the *Inbred aire* had no passage out. For when this Inbred aire is moued if it could not retire backward, it must passe the membrane outward toward the eare, & the outward aire we know forceth it inward by which two contrary inforcements it could not but be endangered, whereas now the inbred aire hauing an out-let into which it may retire, it leaue the membrane scope and roome to yeld to the impulsion of the outward ayre.

How this pas-
sage is found
in a skull.

He that would find this passage must take a dried skull and put a hogs bristle into the hole of hearing, and he shall perceiue that it will issue out again in the palat of the mouth. But in a greene head the holes of this canale are very conspicuous in the same palate. And thus much of the canale which runneth from the eare vnto the mouth, as also of the externall part of the stony bone within the skull with the proceffe and holes that belong vnto it.

Of the super-
ficies of this
bone without
the skull.

The other part of the exterior superficies of this stony proceffe or rocky bone without the skull is diuersly exasperated and made vnequall with knubes, bosses or cauities, porosities or smal holes and lines running in it. So that the ancients did rightly compare it to a craggy rock. The use of which inequalities is, that from them the muskles might better arise and into them be better inserted.

The mammil-
lary proceffes
of the stony
bone.

This bone also hath belonging vnto it a proceffe and an Appendix. The proceffe is some-
what thicke, and because it resemblerh the teats of a womans dug it is called *μαστοειδης mammil-*
laris. [tab. 3, lib. 7, fig. 8, M, fig. 9, K] This proceffe is not found in infants, but ariseth afterward.

Of the appen-
dix Styloides.

The appendix is slender, long and sharpe, and therefore called *στυλοειδης*. *Coster* calleth it *Os sa-*
gittale, os clauale, os acuale; from the resemblance it hath with an arrow, with a nayle, or with a
needle. It is also called *στυλοειδης*, because it is like a spur. [tab. 3, lib. 7, fig. 9, i] This Appendix
in infants new borne is gristly, but afterward becommeth bony when the bones grow and the
gristles are dried, yet for the most part as it is in other appendices there remaineth in it some
remembrance of a gristle. But of these wee shall speake more at large in our discourse of the
bones of the head. In the meane time thus much shall suffice to haue said concerning the ex-
ternall superficies of this stony proceffe of the Temple bones or of the rocky bone whether
you will, as well within the skull as without.

The inside of
the stony bone

On the inside this stony bone is not solide, the reason was, that it should not be too heauy,
but thrilled and perforated with infinite holes, dens and serued passages, [tab. 18, lib. 7, fig. 2,
4, 5, 3, 2, m n E i] and in a word the greatest part of it is a very sponge wherein the implanted
or inbred ayre is laboured or perfected. But in the midst of it there are three notable caui-
ties formed, especially to help our hearing; the small partitions of which cauities, although
they bee very thin because the bone should be light, yet are they very fast and strong bones.

Three cauities

But because the membrane of the Tympane or head of the drum is interposed betwixt the
hole of hearing and the first of these cauities, we will intreat of the Tympane before we come
vnto the cauity.

CHAP. XVII.

Of the Membrane of the Tympane or head of the Drumme.

The names of
the membrane
of the Tyme-
pane.



He Membrane of the Tympane which *Hippocrates* first of all men, in his Booke
de carnibus, made mention of vnder the name of *δέρμα τῆς τῆς ἀκοῆς*, that is, a skinne
in the hole of hearing, is called by *Aristotle* in the 83. text of his second Booke *de*
anima *μῆνις*. *Galen* in the first chapter of his eight Booke *de usu partium*, calleth
it *στυλοειδης*, a lid, and *στυλοειδης*, a covering. Some call it *Tympanum*, because it is
stretched ouer the first cauity as a peece of Vellam ouer the head of a Drumme, or because as
a Drumme being beaten with a sticke maketh a great sound, so this membrane being beaten
vpon by the ayre, communicateth this sound vnto the nerue of sense. But it may most pro-
perly

perly be called not the Tympane or drumme, but the membrane or head of the drumme, because it is stretched vpon the bony circle we shall speake of afterward, and receiuing the impression of the sound returneth the same againe vnto the sense. [tab. 10, fig. 3, and 4, p. tab. 11, d] It is scituated betwixt the hole of the hearing, at whose inward end it is set, and the first cavity of the inside of the stony bone, which cavity we properly call *Tympanum*. It is extended ouer the cavity obliquely forward and vpward, as if a man should couer the sloping cut of a writing pen with a filme: and the reason of this scituation is, because it might more directly respect the first cavity which is somewhat higher then the hole of the hearing. Again, that the violence of the aire, of water or of any such like that might by accident fall into the eare, should not directly or by a right line attaine vnto the membrane to offer it violence.

Scituation.

The reason thereof.

The second reason.

The figure of it.

The figure of it is round [tab. 10, fig. 6, & 7, tab. 11, d] curued a little inward in the midst like that herbe which wee call *Pennigrasse* or *Venus nauell*, the better to receiue the sound which commeth from without, because that which is concaveous or hollow doth more perfectly, and fully receiue the sound.

Concerning the substance and originall of this membrane, there are almost as manie opinions as there be writers. Some think it ariseth from the braine, some from the *Dura Meninx*, some from the *Periostium*, some from the *Pericranium*, some from the nerves of the first coniugation, some from the *Pia mater*. But if it may be lawful for vs to interpose our opinion, we perswade our selues, saith *Bauhine*, that it ariseth from the seede it selfe, as being generated in the first conformation as we said before the membrane of the cristalline humor was generated; and the reason that perswadeth vs thereto, is, because the very substance of it differs from the substance of the others membranes in the Body. But if this opinion should not please, we next of al incline to them who produce it from the *Periostium* because if you dissect the head of an infant, you shall finde this membrane to cleave to the *Periostium* [tab. 11, k k] where it couereth the scaly bone and the neighbour parts: as also that at the hole of hearing the *Periostium* is dilated, where there breaketh or riseth out of the stony bone a little oblique and round proceffe much like a quill when the first oblique incision is made in it toward the framing of a pen, which proceffe was ordained that this membrane might be connected with the stony bone.

Diuers opinions concerning his originall.

This proceffe is called the ring of the bony circle [tab. 10, fig. 3, & 4, tab. 11, e] out of whose circumference the hole of hearing beginneth. This proceffe hath a double originall [table 11, p] the lower groweth out of the scaly bone and resembleth a knub or knot, which bending a little obliquely inward is placed before the doore or entrance of the first cavity, where on the inside it hath a round furrow, or is lightly excavated in the middle round about the circumference with two bony brims or edges swelling out on eyther side, in which furrow the membrane groweth very fast round about, that it might be secured from the violent motions eyther of the externall Ayre entring in, or the internall Ayre beating outward, as it happeneth in oscitations or yawnings when we hold our breath long, or when we blow our Noses.

The bony ring.

Wherefore it is most like that circle in a Drumme to which the Vellum is fastned. [table 10, fig. 3, and 4, q, tab. 11, d] And this bony ring in infants is easily separated from the Temple bone, but in growne bodies it is so close ioyned on one side to the stony bone, on the other side to the hole of Hearing, that a man would not thinke it had beene ever separated from them: neyther indeed can it be separated in growne bodies without breaking. Yet the furrow remaineth still to be seene. And thus the membrane of the Tympane seemeth to be separated in the circumference from the *Pericranium*. But let vs heare what *Galen* can say of this membrane.

Galen inquiring into the substance of this membrane, and instituting a comparison betwixt the covering or coate of the Opticke and the first Nerue of hearing, and afterward of the instrument of smelling, sheweth; That it was not fit these Nerves should be left naked, because then they would haue beene exposed to all outward iniuries. Seeing then they needed a covering, either it must be crasse and thight as that of the eye; or rare and porous, or in a meane betwixt both. It behooued not it should be crasse and thight, because such a covering would haue hindered the accessse of the Ayre when it was mooued, especially if the motion were but easie, as it is when we speake ordinarily one to another. Neyther ought it to haue beene rare and porous, for then the Ayre would haue pierced through it, and so the Nerves should easily haue beene offended and the Braine it selfe refrigerated.

A passage out of Galen, proving that hee knew this membrane.

Wherefore Nature framed a Muniment or defence, to helpe the security of the Instrument, of a moderate

Tab. 10. sheweth the eares and the diuers internall parts thereof.

Figure 1. sheweth the whole externall eare, with a part of the Temple bone.

Figure 2. sheweth the left bone of the Temple diuided in the middest by the instrument of hearing, whereabons on either side there are certaine passages heere particularly described.

Figure 3, and 4. sheweth the three little Bones.

Fig. 5. sheweth a portion of the bone of the temples which is scene neere the hole of Hearing diuided through the middest, whereby the Nerues, Bones and Membranes may appeare as Vesalius conceiueth of them.

Fig. 6. sheweth the Vessels, Membranes, Bones and holes of the Organ of hearing, as Platerus hath described them.

Fig. 7, and 8. sheweth the little bones of the hearing of a man and of a Calfe both ioyned and separated.

Figure 9. sheweth the Muscle found out by Aquapendens.

TABVLA X.



a. The lower eare or the lap of the eare.

bb. The circumference of the eare cald in Greeke *Helix*.

cc. the interior protuberation or swelling of the eare called *Anthelix*.

d. The boate of the outward eare.

e. The Goates beard called *Tragus*, wherein are hairens growing.

f. The place against the Goats beard called *Antitragus*.

Fig. 2. A, A part of the yoke bone.

B, The *Sinua* or bosome whereinto the lower iaw is articulated.

CC. The stony bone swelling within the Scall.

D, The second hole of the bone of the Temples for the passage of the sleepey Artery.

E, A little scale or thin bone betwixt this hole and the first cavity.

FF F, The porosity or sponginess of the stony bone.

aa, The externall hole of the eare.

bb, The bony canale of that passage.

c. The Tympane or Drumme is here placed at the passage.

d, The interior hole into which the nerue is inserted.

ef, Heere also is the stony bone perforated.

ggg, A canale of the auditory Nerue from e, to g. in the bone of the Temples, yet this Canale is described by it selfe at the side of the bone about the fifth Figure.

aa, Two holes in the beginning and ending of this Canale.

γ γ, Two other holes in the externall and internall part.

h, The first cavity, according to some the second, reaching from e to E.

ii, Two canals or pipes of the first cavity.

k, The higher hole which is shut with the stirrop bone.

l, The lower hole alwayes open.

mm, The second cavity in the bone.

1, 2, 3, Three little burrows or holes of the second cavity described apart.

n, The third cavity lying vnder this superficies.

Fig. 3, 4. o 3, A long bone representing a pyramidal Fig.

3 4, the membrane of the drum.

q 3 4, A bony ring at the tympane described also by it selfe.

r 4, The Mallet or Hammer.

s, The Anuile. t, the Stirrop. Fig. 5. A, A part of the hole of hearing. B, A membrane covering the hole ouerthwart. C, The bone of hearing likened to a hammer. D, the auditory Nerue. E, His distribution through the great hole of hearing. F, Another branch falling through the hole whereby a veine doth enter in. H I, A round cavity, in the fore-part whereof is placed, the bone noted with I. Fig. 6. aa, the first hole of the Organe of hearing. β, the auditory Nerue diuided into two parts, where it passeth through the fourth hole. γ, The ingular veine with a part of a nerue passing through the first cavity. δ, Where it passeth through his second hole neere to δ. ε ε, An artery entring that cavity thorough the third hole, and a nerue falling through the same hole. H, the same artery falling through the fifth hole. ii, the lower part of the fifth Nerue reaching vnto the 2, and 3: cavity. θ θ, A higher part of the fifth Nerue brought through the scruiing canale or pipe vnto s, where it falleth out. x, the Tympane or Drumme shutting the first cavity. λ, the three little bones of hearing ioyned together. μ, the third cavity or the Trumpet of the organ of hearing. ν, the second cavity or the mettall mine running out with three burroughs. ξ α, the Canale or water course carrying a Nerue and an artery, opening it selfe with two holes. Fig. 7, and 8. s, The Hammer. σ, the Anuile. τ, the Stirrop.

moderate consistence. And thus he concludeth: Nature therefore foreseeing that if shee had made the construction of that Nerue with a strong Muniment, it would indeede haue beene fitte to beare off offences: but the Instrument of the Sense must of necessity haue beene Deafe. Againe, if the construction of the Nerue had had no defence, it would haue beene very subiect to outward iniuries: and therefore shee tooke a way betwixt them both, and made for the construction of this nerue a helpe, neither too stiffe to hinder the sence of Hearing: nor too rare, that the aire should penetrate through it, but of a moderate consistence, which might not only secure the Instrument from violence, but also receiue & returne the impressions of sounds.

Againe the same Galen writing of the couering of the Instrument of Smelling, saith, that it needed styaqua a Defence more rare then that of the Instrument of Hearing which is fast and thight, because the object of the Sense of smelling is thicker then the object of the sense of Hearing: for the object of smelling is a vaporous substance wherein the odour doeth exhale, but the object of hearing is aire altered only by an impression of Sounds.

By this we may see that Galen was not vtterly ignorant of this membrane, and we haue the rather inserted this passage out of him, because many late Anatomists haue auouched that Galen made no mention thereof at all, but was vtterly ignorant of it. We returne now vnto the membrane.

The substance therfore of this membrane is thin, fast, dry, transluide and of exquisite sence: so thin and fine that Hippocrates compares it to a Spiders webbe, the better to transmit an easy voyce or soft sound (for it was necessary vnto the act of hearing, or if you wil, vnto the passion of Hearing, that the sound should be communicated with the Inbred ayre although the substances of the outward & inward aires are not mingled) & yet so strong withall that it might be able to beare a pulsation which might affect the instrument of Hearing.

The substance of the membrane.

Wherefore Bony it behoued not to be, for then the instrument of sense would haue been deafe, because the inbred aire would not haue receiued the sound and alteration of the external aire, and if the bone had beene so thin that it could haue transmitted the affection of the aire, then also would it haue bin in danger of breaking.

Why not bony.

It was not fit this couering or instrument should be fleshy, because if that which receiued the sound had beene lax or loose it would not so well haue transmitted the impression, for we see that the straiter a drumme is braced the stronger and louder sound it yeelds. Againe, if it had beene fleshy it would haue bin soft and full of moysture, and by that meanes would haue admitted of many things to cleaue or sticke vnto it which now doe fall away from it, because it is membranous.

Why not fleshy.

This partition therfore or muniment, or couering, call it what you will, is membranous and thin withal: for if in the first conformation it be produced a thick & fast membrane, then is the party deafe incurably, as Arantius and Laurentius haue well remembered.

But we find sometimes before this membrane on the outside that there groweth a certain thicke coate beside the intent of Nature, of which Aegineta maketh mention in the 23. chap. of his 2. Book, and Aquapendens saith he foud it twice, but Aegineta teacheth also the way how to cure it, yet it is much to be doubted that if it grow from the natiuity such children will become deafe and dumbe; Deafe because this coate hindreth the appulsion of the sound vnto the membrane; Dumbe because they are not able either to conceiue with their minds or to vtter with their voices, that they are altogether ignorant of.

How children become deafe and dumbe.

And as such a coate or filme before the membrane doth cause deafnesse, so it sometime happeneth that immediatly behinde the membrane there is a collection of mucous matter, or an affluence of some humor from whence proceedeth a great difficulty of hearing hard to be cured: but if the humor be thin then the Hearing is not so much impeached as the patient is vexed with ringings, singings, whistlings and hissing murmures in his eares. Furthermore this membrane is thight and fast, hauing in it no conspicuous pores but neruous and strong, the better to resist outward iniuries and violent incursions of the aire.

It is also very dry that it might more readily receiue the sound, and more distinctly make representation of the same. For we imagine that the Image of the Sound is receiued in this membrane without the matter, euen as the images of colours are receiued in the horny membrane of the eye. Beside Hippocrates saith that drynesse is a great helpe to the conception or reception of sounds, because that which sounderth shrillest is farthest hard, as we haue experience in small bells which are made of thin and fast Lattin plate.

Why the membrane is dry.

This membrane is also transluide and polished like a Looking-glasse both within and without, sauing that on the inside the proceffe of the bone cald the mallet or hammer is extended

The diuers
vses of the
membrane.

vpward vnto the middest thereof, like as we see in the taile of a drum there is a chord stretched ouerthwart through the midst.

The vse of this membrane is to close vp the hole of Hearing in a round compasse, and like a hedge or wall to distinguish it from the fourth cauity of the stony bone, and therefore *Laurentius* calleth it *septum*, the partition. It serueth also to distinguish the externall from the internal parts of the eare; but especially to separate the Inbred ayre, whose duty it is to receiue the impressions of sounds from the externall or the ayre that cometh from without, for if these two ayres had beene mixed and confounded, the outward ayre being oftentimes foggy and thick, must needs haue made the inward ayre also more vnfit for sensation. Neither doeth it onely keep the inward ayre from permixtion with the outward but also containeth it that it should not vanish of it owne accord, or be disperfed and dissipated in vehement noyses or Sounds. Adde hereto that it keepeth out the externall ayre so that neither the cold nor heate thereof can offend the nerues of the braine. Finally it defendeth the inward parts from outward wrongs, so that if a man be ouer head & eares in the water, yet the water cannot passe beyond the membrane: In like manner it keepeth out flies and other such busie creatures, dust and whatsoeuer else should happen to fall into the hole of hearing.

But because the thinnesse of this membrane made it subiect to be violated or indangered by such outward accidents, Nature for more security hath placed on the inside thereof 3. bones a chord or string and 2. muscles whereby this membrane is made better able to endure the force of the ayre when it is beaten against it.

CHAP. XVIII.

Of the small bones of the Organe of Hearing, and of the Chord.

The finders
out of these
bones.



He three bones of the Organe of Hearing were not knowne to Anatomists till the age wherein we liue. Those two which are knowne by the names of the Anuill or the Stithy, and the Mallet or Hammer were inuented or found out by that restorer of Anatomy, *Iohannes Carpus* of Bononia, & the third *Iohannes Philippus Ingrassius* challengeth to himselfe, so doth also *Columbus* & *Enstachius*, & well it may be that all these being so oculate Anatomists did find it out by their industry. But now we haue them, it shall be more expedient precisely to describe them vnto you then to determine who were the first inuenters of them.

The situation

These bones therefore are scituated in the first cauity of the stony bone, which before we called the Tympane that is the drum or taber, and because their figure is diuers they haue also diuers names giuen them, partly from the similitude they haue with things whose names they beare, partly also from their vse. The first is called *Malleus* or *Malleolus* the Mallet or the Hammer. The second *Incus* the Anuill or the Stithy. The third *Stapes* the Stirrop [tab. 10. fig. 6, 7, 8.]

Their names.

The Mallet.

The Hammer or Mallet [tab. 10, fig. 4, r, fig. 5, c, fig. 8, q, tab. 11, c, l] is seated in the beginning of the first cauitie of the stony bone [table 10, fig. 2, neere to c] at the end of the hole of Hearing. This bone saith *Coiter* hath his name rather from his vse then from his forme, because when the membrane is mooued, the Mallet also is mooued therewithall: or because like a Hammer it lies vpon the Anuill, and in the motion beates vpon the membrane. Others doe liken it to the thigh bone, as *Vesalius* on this manner. As the thigh neere the necke thereof hath two proccesses, so this small bone hath two proportionable proccesses in the necke thereof, whereby it groweth more strongly to his membrane. Again as the necke of the thigh bending obliquely to the cauity of the hanch endeth in a round head, so this bone departing inward from the membrane and ending in a round smooth and plaine head, is ioyned to the vpper part of the other bone by the interposition of the membrane, as if a hammer were loofely tyed to a Smiths Anuill. This first bone therefore is long and crooked, hauing a head, a necke, and a taile.

His head.

The head is the vpper and thicker part, long and bunching out, for this head is not perfectly round, as hauing ingrauen in the outside of the top a small and long cauity wherein it receiue the head of the second bone which we called the Anuill, whereto being ioyned, it listeth it vpward and forward to the side of the hole of Hearing.

Necke.

The necke of it is but narrow, yet on the backside thereof do two small proccesses shoote out,

out, which are very slender and sharpe. To the vppermost adhereth the ligament or chord and the lowermost resteth vpon the membrane that it might not be driuen too far inward or broken. But the vse of this proceffe I cannot better demonstrate then by those Chords which they vse to stretch vpon the bottome of a drumme whereby it is secured from the violence of the ayre which is within it; which aire otherwise being so violently and so often beaten, would rend the bottome asunder. Betwixt these is a small cavity and right opposit against it a little knobbe into which one of the Tendons of the Muscles is implanted, as the other is into the necke.

The tayle of this bone which *Fallopian* calleth *Pediculus* as it were the *Stalke* is somewhat broad in the top, but endeth into a small knot which receiue the insertion or tendon of the muscle; (*Columbus* addeth, that into this sharpe proceffe there determineth a small Nerue from the first coniugation which affoordeth a hairy and crooked branch which is inserted into the labyrinth of the eare) presently after it runneth backward and downward, and by degrees endeth into a slender and sharpe proceffe, somewhat rough and a little incurved or hooked, so that it cleaueth to the membrane of the Tympane, not in the end or point of this proceffe but thoroughout his length, yet not in the very middest of the membranes breadth. [tab. 10, fig. 4. from r, to P]

And Tayle.

The reason of this Connexion is partly to defend the membrane from outward violence, that it should not bee driuen beyond his extent (wherein also it is assisted by the chord of which we shall heare euen now) partly to draw it downward and inward, for the proceffe wee spake of is curved or hooked inward, and by this meanes the membrane is made inward conuexe, and outward hollow, in which figure it is also by this proceffe preserved, whence it cometh to passe that the outward aire which entereth the hole of hearing slideth from the sides of the membrane and gathereth it selfe together in the center where the Mallet hangeth, and being so vnited and intended is a great furtherance for the communication of the sound to the inward parts.

Again, as this Hammer groweth to the Membrane [tab. 10, fig. 6, n] by his lower proceffe and the inferiour part of his tayle, as also to the orbe of the hole of Hearing by the benefit of a ligament which runneth ouerthwart from the prominence which is on one side the hole to the prominence on the other so that it is no where at liberty, but on euery side fastned to the membrane: in like manner the head thereof is articulated to the Anuile vpon which it lyeth by that kind of articulation or iuncture which we call *Ginglimos*. [tab. 10, fig. 6, 7, 8.] For in the Hammer and the Anuile there is a cavity and a head, and the Hammer is mooued about the Anuile. Notwithstanding this Hammer and the Anuile after a man is dead are so closely ioyned (whether it be so in liuing bodies it is much doubted) that Nature seemeth to haue as much vse of their continuity and vnyty as of their diuision and plurality: for being two they do better safeguard and defend the Membrane, but their continuation awayleth nowhit lesse for the better conueyance of the sound. Wherefore although the articulation of these two bones is worthily said to be *per Ginglymon* because they mutually receyue and are receyued one of another, yet because of their strait and close copulation some are of opinion that their iuncture is rather to bee referred to that kinde which wee call *Synarthrosis*, the meaning of which words of Art shall bee at full expounded in our last Booke of the bones.

The Connexion of the Hammer.

Finally, the Hammer is a longer bone then the Anuile but withall more slender, because it was to mooue about the Anuile, and wee know it is reasonable that that which beareth should bee greater then that which is borne. Notwithstanding both these bones in the place where they are articulated or ioyned, are much greater and thicker then in their other part, which thing to say true may be obserued almost in the articulations of all other bones of the body.

The forme of it.

The Anuile [Table 10, figure 4, f, Figure 5, 1, figure 7, and 8, b, table 11, m] is the second bone which is situated in the hinder side of the first cavity and lyeth next to the Hammer to which it is opposite, and couereth (sayth *Cotter*) that part of the Membrane which is not covered by the Hammer, yet so that his thicker part is toward the eare and his legges, (if wee may so call them) or his thinner parts toward the Tympane. Some are of opinion as *Columbus* and *Archangelus*, that this bone had his name from his action, because as an Anuile it receiue the stroke of the Hammer, which mooueth about it and beareth against it: Others conceyue that it hath the name from the similitude it hath with a Smiths Stithy or Anuile, not that great one whereon they driue sledges of Iron, but the little and moouable

The Anuile.

The reason of the name.

Why called
Dens.

moouable Anuiles which are partly plaine and partly round. And heereupon *Vesalius*, *Eustachius*, *Cotter*, *Platerus* and *Aquapendens*, (because it is not altogether plaine as a great Anuile is, but hath an vnequall cavity such as is to bee seene in the top of the *Grinding* teeth) haue likened it to a tooth hauing two fangs or rootes, the one longer and smaller, the other thicker but shorter, insomuch as they call it not *Incus* or the *Anuile*, but *Dens* the *Tooth*.

The forme of
it.

This bone is shorter and thicker then the Hammer (*Aquapendens* saith as thick againe) and hath two legs; for in the vpper extremitie it is thicker and swelling, and in a smooth cavity receiue the head of the Hammer: it hath engrauen in it a small *sinus* or bolome, which *Aquap.* calleth an *vnequall cavity*, in the midst whereof riseth a line, as it is in the bone of the *Cubite*

The articula-
tion.

where it is articulated to the Arme, so that the articulation thereof is more truly sayd to bee made by *Ginglymos*, which for the motion is more expedite and ready. And as the head of this Anuile is articulated with the Hammer, so the productions or processses thereof doe grow to the orbe of the hole of Hearing, and to the toppe of the Stirrup or third bone. For the lower end thereof which is also the smaller doth deuide it selfe into two slender and acute processses (which *Falopius* and *Laurentius* with some others doe call Legges) standing off one from another.

The processses.

The higher of these which is the shorter and the thicker, is somewhat broad, a little intorted or bent inward and leaneth vpon the Scaly bone of the Temples, and by a transuerse ligament cleaueth to the walles or sides of the orbe of the Tympane euen there where the water-course slideth, & by this meanes it is tyed more strongly to the hammer, that when the membrane hapneth to be vehemently shaken, the two bones might not be separated one from the other.

The other processse of this Anuill or roote of this Tooth is somewhat longer, slenderer and bending downward; yet sensibly intorted vward, it appeareth about the membrane and is tyed to the top of the stirrup by the mediation of a ligament and affixed thereto by that kind of coniunction which we call *Arthrodia*, occupying that place of the membrane wherein the Hammer is not, whereby it might *Perceine* or receiue the pulsion of that part, and communicate the sound to the stirrup, from whence through smal holes it is ledde along vnto the nerue of Hearing.

The Stirrup.

The Inuenters.

The stirrup [*tab. 10, fig. 4, t p, fig. 8, T, tab. 11, f*] called *Stapes*, is the third bone of the eare, which the first Inuenters did very aptly expresse by this resemblance. Many contend about the Inuention of this bone; among the rest *Columbus*, *Ingrasias*, *Falopius*, and *Eustachius*, all excellent Anatomists and haply all of them as fortunate in the finding it out as they haue bene diligent to search into the secreet corners of man; and therefore we will not determine any thing in the preiudice of any of them. We finde it to be scituated as it were in the midst of the first cavity of the stony bone neere the *Ouall window*.

The figure.

In brute beastes it is triangular, very like the greeke letter Δ [*tab. 10, fig. 8, sheweth the fig. of it in brute beastes*] but in men it may be sayd to bee formed of two parts, [*table 10, figure 7, sheweth the forme of it in men*] the one *Superior* which is bent like a bowe hauing two small Legges somewhat sinuated, which becomming narrow are inserted into a transuerse Basis.

The top.

The top thereof is not sharpe but hath a small plaine and round head, wherewith like an arch it sustaineth the longer processse of the Anuill, or if you wil the Stirrup hangeth to this processse by the mediation of a ligament.

The sides.

The sides or legs of this Stirrup are very small and depart but a little asunder, making a hole betwixt them more long then round. Some say it is Triangular, others of an Ouall forme; but the Basis of the bone (which is the part remaining) is transuerse, somewhat broad and the edge thereof a little thicker then the other part.

The basis:

The Basis also shooteth out a little beyond the legs or side-bones thereof, whereby it is articulated to the bone at the *Ouall window*, and is firmly fastned to the membrane which shutteth the perforation, and that by the helpe of a ligament arising from that side of the head which hath the cavity *Varolius* called it very elegantly $\gamma\alpha\nu\theta\epsilon\delta\iota\nu$ as it were the *Pupilla* of Hearing. And on this manner it doeth exactly represent the forme of a Stirrup, not such a Stirrup as is vsed now a dayes, but such as we see grauen and figured in old pictures and tables, that is, triangular, and representing the fashion of the greeke letter Δ .

The perforati-
on.

Why lesse then
the rest.

This bone is much lesse then either of the other two, for if it had bene bigger or waighed more, then being moued together with the other two, it would haue drawne the membrane

downe-

downward. In the middest it is perforated or open like a stirrop, that it might be the lighrer, and that hereunto the Inbred aire might insinuate it selfe and be moued. Again the better to conuay the sound which it receiueh communicated from the Anuill not only to the depth of the first cavity, but also beyond to the other cavity, and so through the *Quall window* directly vnto the Labyrinth. Wherefore without this stirrop the sound could not haue beene transported into the whole cavity.

For example, as the visible species or forme which is received within the horny coate must first passe through the narrow & streight hole of the *Pupilla* or Apple of the eye before it can arriue at the cristaline humor: so the species or forme of the sound which hath gotten into the concauity of the membrane, must passe vnto the chiefe Organe of hearing through the small hole of the stirrop bone: and thence it was that *Varolius*, as we said euen now, called this hole of the stirrop *Pupillam auditus* the Apple of the eare.

Wherefore, as wee sayd, the formes of Sounds passe through the emptie hole of the stirroppe into the cauities which are wrought by Nature in the Stony bone where they meete with the Inbred Ayre, which may also bee compared to the Christaline humor. For as the Christaline is the chiefe Instrument of the sight in respect of reception of Images or Formes; so is this In-bred ayre of the Eare the chiefe Instrument which receiueh the Formes of Sounds, although there bee another more noble Organ which iudgeth of them.

Moreover, lest these three bones if they should haue mooued inconstantly, might haue endangered the Membrane to which they are firmly tyed by drawing it too much this way or that way, it is fastened to the bone with a small ligament or chord, reaching overthwart from the sides vnto the top of the stirrop. Yea they are tyed together with slender and soft Membranes which doe the office of a Ligament, and that by two ioynts which in their extremities are cruisted ouer with a gristly substance after the same manner that it is in other bones, and so their articulation doth not differ from the Syntax or coniunction of other parts.

They were made three in number (though some creatures haue but 2. as *Casserius Placentinus* recordeth) for their better motion whereby the membrane is secured, which otherwise in violent concussions of the aire might haue beene broken. For if it had beene but one bone, the membrane in impulsioe could not haue giuen place because the bone would not haue bent therewith; or if the proceffe of the bone should haue yeilded, being necessarily so fine and thin, it might easily haue crackt a sunder. Wherefore the membrane of the Tympane is so fastened to the taile of the Hammer that it might not breake when it is violently driuen inward: And againe the taile or handle of the Hammer cleaueth vnto the membrane that it might not be driuen too much outward. But that it might better resist any violent motion outward or inward, there were two other bones added to the Hammer to helpe the flexion; and two muscles whereby the motion is restrayned when the Hammer with the membrane is driuen with violence eyther inward or outward. For the bone which wee compare to a Hammer hath a double motion, as *Arantius* elegantly obserueth, pressing forward and recoyling backward.

Forward or inward according to the motion of the membrane whereto it is annexed, which membrane being shaken by the outward ayre is driuen inward, and vpward, remaining so long gibbous on the inside till the Inbred ayre is affected with the sound, which ayre wandering through the circles, conuolutions and burroughs of the eare, maketh the representations of the Sounds to bee received by the branches or tendrils of the fift payre of Synewes, by which they are conveyed in a moment of time into the Braine. But that this membrane should not be driuen too farre inward, the Hammer opposeth it selfe. The Hammer determineth at the small cavity of the Anuill whereinto the head of the Hammer is articulated; wherefore the Anuill being a firme and stable bone, stayeth the inclination of the membrane, euen as saith *Arantius*, in clocks there are certaine points of iron which will not suffer the wheele to runne beyond the number limited for the time of the day. And as the Anuill is assistant vnto the Hammer by laying a law vpon his motion; (and therefore hath two legges or processees whereby it is fixed to the stony bone and the stirrop) so also the stirrop standing vpon the cavity of the stony bone neere the circles as it were vpon a stable basis, doth elegantly sustaine vpon his head which is built in the manner of an arch, the longer proceffe or leg of the Anuill.

The second motion of the Hammer is outward, for the Membrane of the Tympane together

Why perforated in the middest.

Varolius.

The reason of their connection.

Why more bones then one

The double motion of the hammer.

Inward.

Outward, together

gether with the Hammer when the violence or constraint which before bare them inward is remitted, do returne vnto their naturall station; partly by a naturall motion whereby they recover their former position when the violence is intermitted; partly by the muscle which is an instrument or arbitrary motion; for that muscle is contracted toward his originall and so the head of the Hammer is separated from his structure with the Anuile, and the recured pro-
 cesse of the Hammer beareth the membrane outward. But beside these two bones, the 2. mus-
 cles also of the inward eare do assist the membrane, one of them against the inward impulsio[n],
 and the other against the outward expulsion.

The substance
 of these bones.

The substance of these bones is hard, dense and smooth. Hard for that helpeth the hearing,
 as also addeth a greater strength and firmitude vnto the membrane. They are also dense and
 smooth for the better reception and transportation of the sound; yet *Columbus* and *Cotter* are
 of opinion that the two first are within spongy and medullous. The third is so smal that there
 can be no holes perceiued therein.

How they dif-
 fer from other
 bones.

And as these bones in forme and figure doe differ much from other bones of the bo-
 dy, so also and especially they haue two notable diffimilitudes or disproportions from the
 rest.

The first is that they are not compassed about with the *Periostium*, least saith *Aquapendens*
 and *Casserius Placentinus*, they should be vnfit for the reception of sounds: for if you couer
 a hard body with a soft cloth and then strike vpon it, it will not yeeld so shrill a sound as it
 doth when it is bare or naked.

Why children
 do n[ot] heare so
 well as grown
 men.

Againe, therein they differ from other bones as all Anatomistes doe concur, that they
 are perfect and accomplished at the very birth, hauing the same magnitude then that they
 haue in olde age; partly because man at all times euen from his Infancy hath great neede of
 the Sense of Hearing as well to learne to speake as to gather knowledge: partly because the
 membrane of the Tympane is as much subiect to danger by outward violence in our Infancy
 as in any time of our life. Notwithstanding they are not so hard in Infancy as in old folke,
 for Children are full of moysture: whence it is that Children doe not heare so suddencie
 as growne men, because to the exact perfection of the Sence there is required a notable dri-
 nesse.

Aquapendens addeth a third difference betwixt these bones and other bones of the body: for,
 saith he, these bones of the eare do hang suspended from a membrane. Whence it commeth to
 passe that the externall ayre together with the sound is more easily communicated by the
 Hammer and the Anuile to the ayre implanted in the eare: for Soundes are more liuely com-
 municated to hard bodies, which hang loose as you may perceiue if you tie a peece of Iron to
 a string and strike vpon it, it will yeeld a shriller sound then it will if it be not suspended. But
 this conceit of *Aquapendens* sounds but harsh in *Casserius Placentinus* his eares, though to vs it
 found reasonable.

Why they are
 hollow.

These bones are also hollow, as well to make them the lighter, as also to contayne Marrow
 for their nourishment, whereto we may adde, that that which is hollow maketh a better re-
 sonance.

Their vses.

And albeit these three bones are of all others the least in quantity, yet by that which hath
 beene said, we may conceiue that they are of great vse and necessity. In a word, their vses are
 first to establish and defend the membrane of the Tympane, least it should be torne either by
 inward windes gathered in the braine, or by the violent motion of the outward aire, as in thun-
 der, shooting off Ordinance or such like.

Secondly, they yeeld some assistance vnto the Sense of hearing, for by their help the sound
 is conuaid by a kinde of consequence or succession to the auditory Nerue. For vpon their
 commotion the chord is shaken and the implanted aire is moued to receiue the sound. Now
 the chord could not haue been so vehemently moued by the membrane alone as by the mem-
 brane and the bones; and so these bones together with the chord being shaken by the appul-
 sion of outward aire, doe conferre vnto the distinction of Sounds as the Teeth doe to the ex-
 planation of the speech.

Anatomistes
 are here at a
 losse.

I am not ignorant that many men haue busied themselves to finde out the particular vse of
 each of these bones, wherein what satisfaction they haue given themselves, I know not;
 certainly to vs that reade their writings they giue but little. Their conceits beeing meere
 speculations, and so intricate for the most part, as if they did vnderstand what they would
 haue said, yet they haue not beene able to expresse themselves vnto others. *Cotter* mee
 thinks resoluth very well that their exact history especially for the vse, is not so curiously
 to

to bee sought into, because it is impossible that wee should attaine further then a bare coniecture, and beside something would be left by vs for admiration, especially where our vncertaine guesses cannot bring vs any great profit sauing the satisfaction of an ouer curious conceit.

It remaineth that wee speake of that slender and neruous Chord which is within the membrane. It doeth not indeed compasse the membrane round about, but running thorough the midst thereof is fastned to that ioynte where the stirrop is articulated with one of the Legs of the Anuill. This Chord if it be drawn out is thrice or foure times as long as it appeareth before it be drawn. For the substance *Eustachius* taketh it to be a branch of the fourth coniugation. *Falopius* ingenuously confesseth that he knowes not what to call it, yet resolues to giue it the name of a Nerue, and with him *Coiter* consenteth. *Ingrassias* calls it a thred or a chord: *Aquapendens* a slender rope of the nature of a ligament, or, saith he, if it be not so nor any of the other aboue named, then is it a body of his owne kinde.

Howsoeuer it be framed or of whatsoeuer, the vse of it seemeth to be for pulsation, for as in a Drumme the sound is made by the repercussion of the chord which is streatched ouer the Vellum or the Skin, so in the eare saith *Coiter* this chord receiuing an impression by a beating made vpon it from the three bones, doth strike the inward ayre whereupon Sensation is made.

The Chord.

Diuers appellations.

The vse of it.

CHAP. XIX.

Of the Muscles of the inward Eare.

THe Hammer being articulated to the Anuill with that kinde of articulation which we call *Ginglymos*, it followeth that their motion must be very obscure, now they are moued together with the membrane at which the Hammer hangerh, vpperward and downward hauing one muscle appointed for this motion within the membrane, another seated without it.

The intermall muscle [*tab. 11. fig. 2. 1*] described first by *Eustachius*, and scituated in the stony bone, is exceeding small, there being in the whole body none lesser: and yet the frame thereof is so elegant as no muscle in the body may be compared thereto. It ariseth in the Basis of the wedge-bone in that place where there is a hole made with a root of the proceffe of the stony bone, and an additament of the nowle-bone.

The intermall muscle.

It taketh his originall from a substance much like a ligament. Afterward it becommeth fleshy, and groweth a little broader euen to the very midst; then it is againe angustated or straightned and produceth (*Eustachius* saith) but one Tendon. Whome *Coiter* and *Aquapendens* do follow. But *Casserius Placentinus* and according to him *Bauhine* say, they are 2. very small, [*tab. 11. fig. 5. below i*] one of which is inserted into the vpper proceffe of the Hammer, the other into the necke thereof. But in Dogs a little before the insertion it hath a fleshy and round glandule a little depressed, which is not fixed to the membrane lest if it were drawn by it selfe being very small it should be in danger of breaking.

His originall and progreffe.

This muscle when it worketh draweth the head of the Hammer obliquely forward, and inward deduceth or inclineth it from the Anuill, and bending the proceffe of the Hammer driueth the membrane outward.

That this is the vse of this muscle *Arantius* proueth by an experiment on this manner. If, saith he, in a Greene head that is well dissected till you come to this part, you draw this muscle with a sharpe hooke toward his original, you shall finde it hath a double vse: one that the head of the Hammer wil manifestly recede or depart from the Anuill and be lifted vp, the other that the membrane will be driuen outward.

The vse of it according to *Arantius*.

Now this motion which is made in the eares although it seeme to be voluntary, because it is accomplished by a muscle which is an instrument of voluntary motion; yet it can hardly be perceiued by our selues, yea we heare whether we will or no, the reason is because the muscle is so very small.

Neither do we want examples of many muscles which we know assuredly do worke as well while we sleepe as while we wake, which yet we cannot obserue in our selues, but their motion seemes to be without our consent, as we may instance in the muscles of respiration, of the eies, of the cie-lids, the bladder and the fundament. Yet in some men this motion is more eident, which

Aquapendens
his demonstra-
tion of the
motion of the
muscle.

which also they can at their pleasure moue or containe. The truth of this *Aquapendens* proueth on this manner: The motion saith he, is Sensible, and with a kind of noyse, as if a man should stretch 3. threds a little distant one from another, and strike them with a cittern quill as wee do strike an instrument; or as if a man should scratch ouerthwart the graine of a wanscoate, or imagine it to be like the noise that the Steele makes when you strike fire out of the Flint. This motion is especially perceiued when a man begins to yawne, but in the beginning of it wee heare a kind of obscure or dull sound from the comotion of the aire. But this motion or noise in the aire many men do not obserue, neither doth it seeme to me saith *Casseri*, to haue any vse or to conferre at al to the sense of hearing; for if there be a noise in the aire and at the same time a man shall strue to stirre vp this motion, he shall heare the outward noise more imperfectly. And therefore this motion seemeth to happen either from the necessity of the matter, the Muscles necessarily following the attrition of the Hammer against the Anuile, or else it was ordained by Nature for the auoyding of vapors. For in Agues wherein many vapors do arise vnto the head this noise is frequently heard, which we conceiue to be when as the vapors which fil the cavity of the eares are by this motion dislodged, and yet we may vnderstand that this motion is not altogether at our owne disposition.

Bauhine dez
monstration
thereof out of
the experience
in himselfe.

In like manner saith *Bauhine*, when the eares are purged into the mouth by the passage that way opened, I am wont to perceiue in my selfe a kind of tickling within my mouth neere the roote of the *Vuula*, at which time if I often swallow my spittle, I doe manifestly perceiue by the noise that that motion is ordinarily stirred vp in mine eares: and I perceiue likewise the foresaide tickling to bee appeased when the matter by that meanes is sooner purged into my mouth.

It is lesse in
great Beastes
then in men.

But how commeth it to passe that this motion is perceiued in both the eares at once? It may be answered, that it happeneth in the eare as it doth in the eye: for when one eye is moued, the other also instantly accompanieth it, as we haue shewed before. A man would imagine that in large bodied creatures this muscle might be better perceiued then in a man. But we find it farre otherwise; for although beasts haue it, yet for the most part it is in them lesse and harder to finde then in a man.

How to finde
this muscle.

He that is desirous to find out this muscle, must lightly cut the stony proceffe thoroughout the length, guiding his Knife by a line which runneth there through but not very high, beginning at that part of the proceffe which is next vnto the wedge bone, for the muscle runnes length-wise and so determines into the membrane of the Tympane.

The other
muscle with-
out the mem-
brano.

The other Muscle [*tab. 11, fig. 1, and whose insertion is at b*] is situated without the membrane of the Tympane in the vpper part of the hole of Hearing about the middest thereof. Concerning the inuention thereof two excellent Anatomists of Padua in Italy doe contend. For *Hieronymus Gabritius ab Aquapendente*, whome therefore we call *Aquapendens* affirmeth, that he found it in the yeere 1599. But *Iulius Casserius Placentinus* auoucheth, that he obserued it the 7. day of March, in the yeere one thousand five hundred ninety three. But out of question they both haue deserued wonderous well of this Art which of them soeuer was the first inuenter thereof.

Bauhine hono-
rable remem-
brance of *A-*
quapendens &
Placentinus.

And because, saith *Bauhine*, I would haue the world know how much I esteeme them both, I will set downe both their descriptions thereof, beginning with *Aquapendens*, because hee is the Ancienter, not to derogate from the other, seeing I loue and honor them both. The one was my maister in the yeeres one thousand five hundred seuentie seuen, 1578. and 1579. the other in the yeere 1579. was my friend and fellow-Student, and this friendship to this day we maintaine by entercourse of Letters, and shall do I doubt not so long as we liue. *Aquapendens* therefore hath it thus.

Aquapendens
his description
of this muscle.

Furthermore this yeere 1599. I found a muscle in the hole of hearing, cald words *anastinos* [*tab. 10, fig. 9*] which is without the membrane very small, fleshy and not without a tendon which proceedeth directly from the midst of that hole or passage, till it be inserted into the very center almost of the membrane on the outside iust against the place where the hammer on the inside is fastned to the membrane, which together with the Hammer it draweth outward. You shall finde this new muscle if in a Greene head you cut the vtter shell of the bone which maketh the Hole of hearing on both sides, which you may best do with a Chizell and a Mallet, and so remoue the bone carefully to the sides, for so the Muscle will appeare, and yet I haue not bene able to finde it in all my latter dissections, although I esteeme the necessity of it to be so great that I thinke it was rather the fault of my diligence then a defect in Nature. Thus farre *Aquapendens*.

Pla.

Casserius Placentinus
In a man there
fig. 1, a, b] about
folded together
de into a fleshy
ing also a Tendon
by degrees, and
the membrane ne
ry or termination
temple bone from
the Hammer, be
cle if I attribute
serued it the seue
centinus
The view well
The view of the
broken or torne
places. For on the

Table 11. Shew
bones of the eares.

FIG.



Casseri *Placentinus* describeth it on this manner.

In a man there is another Muscle situated in the vpper part of the hole of Hearing, [tab. I I. fig. 1, a b] about the middelt whereof the skin and the membrane which being implicated or folded together do inuest the said hole, do evidently degenerate for the forming of this muscle into a fleshy body: but almost membranous, distinguished or lined through with fibres, having also a Tendon. The figure of the muscle is round and in the progresse groweth slenderer by degrees, and so passeth directly on vnto the Tympane. It is inserted not into the outside of the membrane neere the center, but the tendon (which it transmitteth with a double extremity or termination into the cavity of the stony bone betwixt the Tympane and that part of the temple bone from which the bony ring proceedeth) is fastned on the inside into the head of the Hammer, betwixt the vpper and the lower processe thereof. The inuention of this muscle if I attribute to my selfe I shall not defraud any man of his due commendation, for I obserued it the seuenth of March in the yeere 1593. in the presence, &c. Thus far *Casseri* *Placentinus*.

Placentinus
description.

The vse as well of the Internall as of this externall Muscle *Aquapendens* thus expresseth.

The vse of these muscles is for the security of the membrane, for because it might haue bene broken or torne either on the inside or the out, Nature provided a strength or defence in both places. For on the outside the aire being violently moued might haue broken the membrane

Aquapendens
his opinion of
the vse of the
muscles.

Table II. Sheweth the Muscles placed in the cavity of the eares, with some other canities and bones of the eares.

TABVLA XI.

FIG. I.



FIG. II.



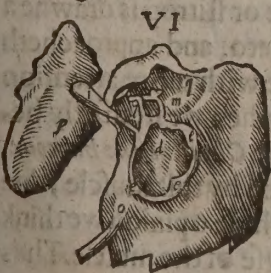
III



IV



VI



VII



VIII



IX



a, b, The externall Muscle whose insertion is at b.

c, The Hammer of the tympane covered with the Membrane,

d, The membrane of the tympane.

e, The bony circle.

f, The bone called *Mastoides*.

g, The temple bone.

h, The circle of the first cavity.

i, The internall muscle whose bifurcated tendon is shewne in the fifth figure.

k k, A portion of the *Pericranium* or scul-skin going vnder the bony Circle, making the membrane of the tympane or Drumme.

l, The Hammer lying vnder the membrane.

m, The Anuile.

n, The breach of the bony circle at e, where the beginning and termination of it is.

o, A part of the yoake bone.

p, A part of the bone called *Basillare*.

q, r, The first cavity.

s, The Stirrop.

t, The circumference of the Shell called *Concha*.

u, A protuberation or swelling in the middle of the cavity.

by thrusting it inward, and on the inside by beating it outward; in the outside the externall ayre which with violence together with the sound rusheth into the eare, on the inside the aire which thorow the mouth getteth into the eare doth forcibly sometimes drive the membrane from within outward, and in this manner is the membrane stretched ordinarily in yawnings, blowings of the nose, retention of the breath, strong contentions, lowd voices, the excretion of excrements, and such like violent constraints. The externall muscle therefore when the membrane is driven inward draweth it back, and as it were recalleth it into the right place. In like maner, the internall muscle retracteth it inward when it is turned or driven outward. And these are the necessities for the satisfaction whereof Nature ordained these two elegant muscles, to wit, for the preservation of the membrane.

The reason why the custody of the membrane was committed to a muscle, that is to an instrument of voluntary motion, is rendred on this maner. If any other tie but that of a muscle had bene made the *Custos* or *Vindex* of this muscle, such a tie must have held it alwaies stretched or tentred alike, and so the membrane would rather have bene more endangered then any whit secured. Besides, it was very necessary that as the impulsions of the aire vnto the membrane are diuers, so there should be a variety of power in that that was to curbe or limmit those diuers motions or impulsions. Such a variety of power cannot be imagined to be in any Ligament but onely in muscles which make their operation with a certaine Analogie or proportion to the finall end which Nature intends, or according to measure; contracting and relaxing themselves more or lesse as neede shall be, accomodating their motion diuersly according to the diuers impulsions of the aire; for they suffer the membrane only so to receiue the offered violence, that neither the violence might bee altogether withstood but that the membrane might yeeld thereto, nor yet the membrane bee outraged by such violence. In a word, these muscles partly by yeelding and giuing ground, partly by obliuation or opposition do secure the membrane from being torne and rent asunder. Thus far *Aquapendens*.

Placentinus
opinion of the
use of the mus-
cles.

Placentinus thus. The muscles of the inward eare do one of them assist the Hammer against internall impulsions, the other against externall. The outward muscle which I found out, that sendeth his Tendon into the cavity of the stony bone and ioyneth it selfe with the greater proceffe of the Hammer, draweth that part of the Hammer outward which inclineth inward, and so moderateth the compression thereof made vpon the Anuile, that it is a defence against the internall muscle.

The Internall which ariseth from the wedge bone and passeth into the cavity of the stony bone vnto the Head of the Hammer into which it is inserted, succoureth the same against the former when it is driven inward, defining & limiting his introcession. For when the tympane by an irruption of outward aire, is together with the hammer driven inward, this muscle resisteth their motion that the tympane and the hammer should not be constrained beyond their Tether and so suffer laceration. Thus farre *Placentinus*.

Varolius his use
of a muscle in
the Eare.

Varolius concerning this matter (for we account him also among our classicke authors, especially concerning the head) writeth on this maner.

Although, saith he, the sound do moue the sence of Hearing whether we will or no, yet there is in vs a kind of voluntary Animaduersion which we exercise in all our senses at our owne pleasure when we would iudge curiously of any sensible thing. Wherefore as by the helpe of the muscles of the eye men do voluntary direct the center of the cristalline toward the obiect which they attentively behold, so within the organ of Hearing there is placed a smal muscle, which arising from the fore-part is inserted into the articulation of the triangle (so he calleth the *Stirrop*) with the Anuile: when this muscle is contracted, the triangle or stirrop is drawne a little forward, the ioynt of the Anuile with the Hammer yeelding thereto, and approacheth more directly to the center of the Tympane, and at that time we heare with more attention and better iudgement, like as we are able to see the least visible obiect when we stedfastly behold it by a line concentricall to the *Horny membrane*, the *Pupilla* and the *Christalline humour*. Some haue imagined that the small bones of the eares diuersly moued by this muscle, doe make within the organ of hearing many and different sorts of sounds, whose opinion we think sufficiently confuted by the former assignation which we made of the use of the muscle. Thus farre *Varolius*.

CHAP. XX.

Of the Cavities of the Stony bone.

Albeit we purpose in the Booke of Bones as particularly as we can to follow their history; yet because this Stony bone and the dissection thereof is most necessary for the understanding of the manner of the sense of Hearing: Wee haue determined to make our particular description thereof in this place; and to passe it ouer with little more then bare mention in the Book of Bones.

Why wee in-
treat of this
bone here.

Although therefore (as before is said) the stony bone is within altogether *Cavernous* and spongy, and that the Ancients haue made mention of one onely Denne or Cavity therein: yet we wil reckon vnto you 3. notable ones and of great moment, which also the *Neotericks* or later Anatomists haue called *Dennes* and *Caues*.

3. Cavities.

These Dennes or caues are formed in the middest of the stony bone where it swelleth most, to containe the Organs of Hearing, that is to say, the membrane, the three small bones, the internall muscle, the chord, the auditory nerue and the inbred aire, which also is called the internall *Medium* of this Sense. All which caues may more distinctly and distriktly be demonstrated in Children, then in growne Men. *Placentinus* findes them also very conspicuous in Birds. They haue each of them proper names borrowed from externall things: the first is called *Concha* or *Tympanum*, because it is like the shell of a winkle or a Taber. The second is called *Labyrinthus*, because of the turnings therein. And the third is called *Cochlea*, because it is like a Snail's shell.

Their names.

The first [tab. 10, fig. 2, b, from c, to E, tab. 11, q, r] cavity is layd open, when the membrane of the tympane is taken away. It is called *Concha*, as we said euen now, because it is like a winkle or Periwinkle, so acknowledged by *Aquapendens*, *Placentinus*, *Arantius* & our author *Baehne*, although I know there is great contention against *Aristotle* in this point, who seemeth first to haue giuen this name to this cavity. But we stand not vpon names so much, so we know the thing signified by the name. The better appellation as me seemeth is a Tympane, because this cavity couered with his membrane resembleth a Drum or Taber, for when the membrane is stricken by the Sound it resoundeth againe, as a Drum if it be beaten (by reason of the aire therein contained) rendreth a great sound.

The 1. cavity.

The reason of
the name.

Coiter reprehends *Falopius* and *Platerus* for this appellation, because, saith he, in this cavity there are holes and windows, and diuers windings which a drum hath not. To whom we answer, that in men it hath the name of a Drum or Tympane from the vse; but in brute Beastes not only from the vse but also from the figure, because in those creatures that chaw the Cud it is very like to a Turkish drum. This cavity is also called by *Coiter* and *Placentinus* the *Bason* & the *Denne*. It is excavated or hollowed in the beginning of the stony bone, betwixt the roots of the *Mammillary* prolesse, and the place where the head of the law is inserted or fastned to his ioint. The vtter part thereof regardeth the hole of Hearing from which it is onely separated by the membrane [tab. 10, fig. 2, from h, toward c.]

Coiter's object.
Answered.

Hence it is that if the inside of the eare bee inflamed or vlceraed, vpon the motion of the Note, lower iaw the patient is pained in his eare.

The inner part of the cavity is by a thin scale distinguished from the hole of the sleepe artery [tab. 10, fig. 2, from h, to L.]

This first is the greatest cavity of the three, and by a successiue ingresse or continuity of passage is ioyned with them, by which meanes it is able to containe a greater quantity of inbred aire, and also receiue at the same time diuers sounds comming from diuers quarters.

But because the internall aire must first be moued by that which is without, and then transport the image of that sound wherewith it is moued to the auditory nerue, it was very necessary that it should be purged and kept pure from any stayne of corruption, that like a neate glasse it might represent the image offered vnto it. For this purification and expurgation of the inward aire, Nature hath placed in this cavity diuers instruments: some seruing for Pulsation, some for Traiection & some for Expurgation. For Pulsation serue the three bones, the chord and the muscles. For Traiection or conduction vnto the other cavities serue two perforations commonly called *Fenestella* or the windows. For Expurgation there is a passage which leadeth into the pallar. All the particles did require a large cavity, whence it was that Nature framed this stony bone long and round, that so it might containe the more. Furthermore, this cavity

The organs in
this cavity.

Why this is
single.
A witty conceit
of *Aquapendens*

is but single, whence it comes to passe that though there be many noyses made together, yet they are at the same time receiued. For if this first cavity had bene distinguished into many dens, neither would the sounds haue bene receiued at the same time nor after the same maner intertained & iudged of by the faculty, for the diuersity of reception would also haue induced a diuersity of apprehension, as *Aquapendens* very wittily hath obserued.

The fashion of
the cavity.

The interior superficies or inner surface of this cavity is vnequall, being in some parts depressed and thrilled through, in others knotty and swelling. Immediately behinde the membrane it runneth vpward toward the forepart, where also it becommeth narrower, afterward it is dilated and tendeth backward toward the top; then as if it were another cavity it is produced or lengthened downward; which part saith *Coster*, in a man is like a bladder. [table 11, fig. 8, and 9.] In a calfe like a waggens budget, in a kid and lambe like a market womans pouch. It is also rough and spongy; rough, that it might receiue the sounds and not reflect, returne or double them, for if it had bene leuigated, that is, smooth and equall like the arch of a Church, it would haue returned an Eccho. Spongy also, that if at any time the noyse should happen to be so strong that it might offend the hearing, the force thereof might be abated in those small holes. Moreover, in that spongy porosity the Inbred ayre is laboured and brought to perfection. But when I say, it is spongy, I would not haue you conceyue that it is soft as a sponge but porous, for otherwise it is exceeding hard and stony, thereby yeelding and returning a quicker sound.

Why porous
or spongy.

How lined.

Againe, some parts of this cavity are lined ouer with a membrane produced from the *Pericranium*; for after the *Pericranium* hath framed the membrane of the Tympane, it is duplicated and diuersly diuided, so as some of it doth inuest certayne parts of this cavity.

The necessity
of the parts of
this cavity.

But because this cavity was destined for the reception of the implanted or Inbred ayre, which was to receyue the outward ayre altered by the sound, it was very necessary that it should receyue some kind of percussion: but being by the membrane distinguished or diuided from the hole of hearing, it could not receyue the alteration of the outward ayre without some other helpe, which helpe is pulsation, and that pulsation is accomplished by the three bones, the chord and the muscles.

Now that the Internall ayre being affected by the pulsation of the outward ayre altered by the sound, might carry this affection vnto the sense, there was made certayne canales wherein the inward ayre might be conuayed vnto the auditory nerue, to wit, the two *Windowes* with a passage into the *Labyrinth*. Furthermore, it was also necessary that this implanted ayre should be preserved pure, as also bee cherished and sustayned by the ayre which wee draw in at our mouths, to which purpose Nature hath created a canale or passage out of this cavity into the pallate, by which it is purged and receyueth new ayre for his perpetuall nourishment. Of the Instruments seruing to pulsation, we haue entreated at large in the seuenteenth and eighteenth chapters; of those seruing for expurgation very particularly in the nineteenth chapter; and both wee haue repeated in this. It remaineth now that wee prosecute those Organes which serue for Traiccion or transmission of the affected syre vnto the auditory nerue, and so to the first sensor.

CHAP. XXI.

Of the two Windows called *Fenestella*, and the water course in the first cavity.

The first.

Fenestra ovalis

IN this cavity there are two holes very small, which some men call *Fenestra* or *Fenestella* the windowes. These regard the orbe of the hole of hearing as from a higher place. The first which is the foreward and the higher and looketh toward the face, [table 8, figure 4, and 5, F. table 10, figure 2, k.] being as it were in the midst of the cavity, is of an Ouall figure or like an Egge, and therefore it is by some Anatomists called *Fenestra ovalis*, the ouall window.

It is somewhat long and flatted on the sides, and in the backe side it openeth it selfe into the *Cochlea* or the least cavity with a large mouth and becommeth so like the forepart of the *Cochlea* that a man cannot tell whether that this Ouall window open into the *Cochlea*, or the *Cochlea* into it. This also ioyneth it selfe with the posterior hole, and passing inward is dilated, and maketh as it were a Marker place or is like the cavitie of a mettall Mine, (for thus the anatomists haue pleased to compare litle things with great) from which many streets,

wayes

wayes or burroughs do run. Vpon this lieth the basis of the stirrop, and for the most part closeth it vp.

The other hole or window is the posterior and lower. [*tab. 8. fig. 3, 4, G, tab. 10. fig. 2. l*] It is round and lesse then the former and somewhat narrower in a man; but in a Calse and a Sheep saith *Placentinus* it is somewhat larger, and a little extuberating or bunching out; alwayes open it is and declining toward the backside of the cavity, and yflueth together with the former through the bone making a double canale.

Betwixt these two windows [*tab. 10. fig. 2. k and l*] about the lower hole is there a little knob or protuberation, which together with the round hole and the strutting bunch placed vnder the vpper part, may be compared to the little bosse (saith *Placentinus* and before him *Vesalius, Coiter* and *Platerus*) wherewith they vse to adorne the cheeks of a horses bit. In this lieth the chamber of the third cavity which is called *Cochlea*, of which we shall heare more in the next Chapter.

The vse of these windowes is, by pulsation to receiue the sound communicated to the implanted ayre, and to transmit the same to the other cavities that follow.

The lower hole is clouen into a double pipe which ly one vpon another [*tab. 10. fig. 2. i i*] and are diuided onely by a thin bony scale, the one of them together with the Quall window passeth to the *Cochlea*, the other goeth into the Labyrinth or the second cavity of the stony bone. The more forward of these admitteth a surcle of the Iugular veine, and sendeth out a branch of the first coniugation. The posterior is compared to a Water-course [*tab. 8. fig. 3. H, tab. 10. fig. 2. g*] because it is like the pipes wherein water is conuayed, imagine it to be in a Serpentine Still, some call it the Snayly pipe. The Ancients and *Galen* call it *Cacum meatum* the blinde passage, others *Capreolaxis*, that is, writhen or intorted, not because it is blinde, but because if you put a Hogges bristle into it, it will hardly finde an yssue. And truely in the dry skull of an Oxe you cannot finde way for a bristle by any meanes.

It passeth writhen, first forward then backward obliquely about the hole of the first cavity. From thence turning downwards it determineth into the fift hole of Hearing. [*table 10. fig. 2. a b y d*] It is full of holes; in the beginning is that which is marked with [*a*] commune to it with the vpper part of the passage of the auditory nerue. Afterward in the middle of the passage on the outside in the forepart of this canale [*d*] it maketh the first hole of Hearing and letteth fall an artery; so also in the inside [*y*] at the beginning of the second cavity it openeth it selfe. In the end also it hath another hole [*b*] which determineth into the third bone of Hearing. Through this canale is the greater part of the auditory nerue as also an artery diuersly deduced and dilated. For because it was necessary that the branch of the nerue of the fift coniugation should grow hard, it was also fit it should be conuayed thorough the hardest, driest and most contorted passage, especially seeing there was no other way where through it might be conuayed.

CHAP. XXII.

Of the Labyrinth and the Cochlea or Snayle-shell, that is, of the second and third Cavities of the Stony Bone.

THe second Cavity because it is full of windings & turnings like a Conny-burrough, is called *Labyrinthus* and the Mine. It is insculped or excauated in the Posterior and anterior sides of the stony bone or in the root of his proeasse, and is distinguished or denided from the hole of the nerue of Hearing, onely by a thin scale. [*tab. 10. fig. 2. betwixt m and e*] It is round and lesse then the former: and when it hath (vnder the knob and behind the Quall window) ioyned it selfe to the following cavity; attayning inward it is dilated and maketh as it were a Market place, or the broad floore of a Mettall Myne as before is saide, from which many wayes run out, which proceeding thorough the hard substance of the bone like a hollowed circle, doe againe returne into a large Chamber.

These wayes we call burroughs with *Falopius, Coiter* and *Platerus*, or with *Placentinus* bony Semicircles. [*tab. 8. fig. 4, and 5. NNN, tab. 10. fig. 2. m 1, 2, 3, and particularly m with the Characters 1, 2, 3. fig. 6. V*] Of these we make three, which do so passe that two of them do twice interse& themselves with right angles, but the more manifest intersection is made about the top of the third cavity where the hole endeth which receiuerth and transmitteth the nerue of the fift coniugation-

In their originall they are ample or large and become narrower by degrees, because it was not fit that the Sound should passe through a broad space; afterward running through the substance of the bone in circular reflections, they returne to their beginning, yet so that in their whole progresse they neuer manifestly open one into another.

The first.

One of these (which is the lower) runneth from the forepart of the cavity diuerting or turning aside outward yet still in the same cavity, afterward it is reflected and runneth thorough the posterior angle.

The second.

The second issueth out of the same anterior angle, and arising vpward after it hath made a semicircle, it returneth through the posterior angle.

The third.

The third ariseth and determineth in the backward angle of the cavity: for beginning there, it perforateth the bone with a circular cavity tending outward, and so returneth thither againe. And all these in young Infants may be separated whole from the cavity and from the crust wherewith the bone is lined, but in time they grow stony and are vnited. These canals or burroughs could not be made long because of the shortnes of the stony bone, although it had beene very profitable, because length maketh the sound be better perceiued. Wherefore Nature recompenced their shortnesse with circunvolutions, and indeed the gyrations do better helpe the Hearing then length would haue done, because in them as it were by degrees the sound is by little and little laboured, and ascends broken and diuided into the braine. Furthermore, the burroughes in their inward superficies are inuested with a very soft and fine membrane.

The reason of the meanders.

Their perforations.

These burroughs by their egress and regress into this cavity make fixe holes: beside, from the first cavity into this are two holes, and moreouer certaine small ones from the lower hole of the auditory nerue and from the common canale. [table 10. fig. 2. 7] The cavities or holes, saith *Aquapendens*, are so innumerable and intricated one with another, that it may well be called a Labyrinth. For their number they are rather to be admired then numbred, neither can a man finde any order in them, and if any man should attempt any such thing, it were a worke of a vaine and addle witte, albeit *Placentinus* thinketh it feasible. For cut any part of this bone, and beside the vmoost crust you shall finde the rest of the whole bone to be full of holes, pores and dennes, yea altogether spongy, as is touched partly before.

The vse of the conuolutions.

The vse of the Conuolutions and Meanders is, that the sound being conuayed through so narrow passages might be more sharpe and not be dissipated; and this we may see in Instruments of musick, for a Flute or Corner by how much it is the longer and the narrower, by so much is their sound more shrill: the reason is, first because the ayre remayning quiet and at rest in the canale doth more easily receiue the alteration proceeding from the sound then it would doe if it had scope wherein it might be troubled and disturbed. Again, the ayre concluded in a narrow roome is not dissipated but vnited, and so remayning yeeldeth a greater & quicker representation of the sound vnto the nerue, then it would do if it were dispersed.

The third cavity.

The third cavity is called *Cochlea* or the Snail shell from the sinuing obliquity of his passage; which elegantly resembleth the wing of a Snail or Periwinkle shell [tab. 8. fig. 4. and 5. O. tab. 10. fig. 2. vnder n] especially if you take off the vpper part of the shell till you come to the narrower part thereof where the scruiing begins to be thicke. *Vesalius* calleth it *Antrium Buccinosum*, the Den like a Trumpet. The Ancients called it the blind hole or the blind cavity, because they thought it had no through passage. But the truth is, that though it be much intorted and writhen, yet it hath an yssue in the midst, in that place where the gyrations are fastned from the beginning to the end, and this yssue is narrow and direct. For if this cavity had beene blinde without an out-let, the ayre being beaten could not haue attained to the nerue of Hearing.

Where situated.

This is farre lesse then the former two, scituate in the forepart of the proceffe vnder the knub of the first cavity, that it might meete with the Sound which proceedeth from behinde forward, and is distinguished from the canale, which we saide was like a watercourse (placed in the midst of the stony proceffe) by a thinne bone like a bridge. [table 10. fig. 2. betwixt n and f]

The figure.

It is long and crooked and hath three gyrations sometimes, sometimes foure, one of them receiuing another after the manner of the *Cochlea* or Snail shell, by which it is intorted somewhat inward and downeward. But the broader scrue standing highest receiue the nerue; the narrower standing lowest determineth in the cavity of the bone, and worketh it selfe also a passage. Into this endeth the hole of the first cavity called *Fenestella ovalis*, which *Platerus* calleth the lower hole and *Placentinus* the vpper [table 10. fig. 2. l] I meane into the greater gyre of this bone.

This

This bone of the *Cochlea* or the *Snail* shell consisteth of two kinds of circles, whereof one is made of a bony substance very thin and dry, which may easily be crumbled, and on euery side like a *Snake* rowled vp into bights. The other was first propounded by *Eustachius*, *Eustachius*, which is made of a soft and mucous matter yet firme and hath I know not what kind of sandy matter mingled therewith. It ariseth out of the middle space of the first conuolutions, as it were out of a large basis, and being by degrees extenuated, endeth in a sharp point but it ascendeth not so high as that it toucheth the circumference of the bone whereinto the first gyrations doe determine.

This wonderfull prouidence of our Creator, *Empedocles* as *Galen* witnesseth in his Booke *de Historia Philosophica*, did first intimate, when he saith that the sense of hearing is made by the impulsion of the ayre, or of a spirit which striketh and beatech the part like a *Snail*es shell, suspended within the eare like a bell. And with him agreeth *Aristotle* in the 11. Chapter of his first Booke *de Historia Animalium*, where he saith, that the inward eare which is like the contortions of a *Snail*es shell, endeth in a bone which is like the outward eare.

This third cavity as also the second and the burroughs thereof, are inuested with a soft and thin membrane, after the same manner that the sockets of the teeth are. *Vesalius* saith it is a part of the nerue of the fifth coniugation, and that it doth inuest but some parts onely of the cavity, not all throughout. Into this cavity as well as into the former do run three or foure holes so small that a haire will scarce passe through them, yssuing out of that canale through which we said the auditory nerue doth passe; through which holes certaine nerues of the first coniugation, or at least their faculty is communicated to the foresayde membrane. So differeth *Bauhine* from *Vesalius*.

And although it is generally beleued that the sense of hearing is especially made in the first cavity, yet it cannot be denyed but that it is also made in the others; seeing into them as is said, there are furcles of nerues deriued, and in them also Animall spirits and Inbred ayre is contained. Notwithstanding the two hindmost cavities were rather made to hinder an *Eccho* or reflexion of the sound to the first cavity. And whereas these cavities haue holes of diuers magnitude, length and figure, it is reasonable to think that they were so framed for the difference of sounds. For a base sound and a great quantity of ayre require a large hole.

The length prohibiteth the *Eccho* and the reflection of the sound, wherefore the greater sound required longer canales, and the lesser shorter, that the sound in them might as it were, be appeased, and an *Eccho* prohibited. The variety of the figure maketh much either for the naturall dilatation or transmission of the sound and the ayre, which runneth for the most part through circled meanders; or that the sound in them might rest: now we may easily imagine that a sound will sooner cease or be appeased when it runs through many turnings or gyrations then it would doe if it were conuayed by a straight line.

But the vse of this third cavity *Cotter* elegantly sheweth and confirmeth by an instance in a circled instrument, put case it bee a *Sackbut*. For if a man lay his eares to the holes of such an instrument, he shall here a wonderfull whistling and hissing noyse and murmure: where if a man blow into it with his mouth it will sound like a *Trumpet*. And thus much concerning the stony bone and the cavities thereof: now we proceed.

CHAP. XXIII.

Of the Nerue which arinueth at the Eares.

At length we are come to the Auditory Nerue which maketh that coniugation which is commonly called the fifth. [tab. 21. lib. 7. fig. 1, 2, 4. tab. 15. lib. 7. fig. 20. M] It yssueth out of the transuerse proceffe or bridge of the *Cerebellum*, and is a thicke and large nerue; therefore neereft of all to the After-braine because it was to conuey a great quantity of Animall spirits. It insinuateth it selfe into the first hole of the stony bone, with a large perforation and made of purpose within the scull for the transmission of this nerue, which it hideth all the way it runneth foreward, till in the middle almost of the stony proceffe it is diuided into two vnequall parts: the one large and ample, the other small but harder; harder I say then the other, not through out the length of it, but onely in that part which is longer then the former. For (that we may say so much by the way) the softnes or hardnesse of a nerue dependeth vpon 3. things First, vpon the

Empedocles

Aristotle

The membrane inuesting this cavity. Vesalius

Bauhine

The vse of these cavities

Why perforations are of diuers kinds

The vse of the 3. cavity after Cotter

Where it ariseth

How many waies a nerue becomes hard and soft

the originall, so those nerues that arise out of the Braine it selfe are the softer; those that arise out of the After-braine or out of the spinall marrow are the harder. Secondly, vpon their distance, as they are farther from their originall, or neerer vnto it. So the Opticke nerues are the softest of the whole body, because they are neere to their originall; the nerues of the hands and feete the hardest, because they are farthest off. Or, thirdly, it hangeth vpon their contraction: for from their contractions with hard bodies as bones and gristles, or with soft as fat and vessels, they become harder and softer as *Placentinus* hath obserued, but this by the way.

2. Branches.

Small threds
of the audito-
ry nerue.

Why those
that are borne
deafe are also
dumbe.
The very
nerue of
hearing.

This slender production of the nerue through the vpper hole of the fore mentioned passage entereth into that secret bony canale which we called the *Watercourse*, and so creepeth toward the forepart of the head. Afterward it is reflected and entereth into the first cavity, and falling downward and backward, it yssueth out of the bone at the roote of the lap of the eare, and is subdiuided into three especiall branches. The larger and vpper runs out into the fore-side and the backside of the roote of the outward eare. The lower deriued through the iaw, is distributed into the *Masseter* muscle and the first muscle that mooueth the cheeks. The third which is the middlemost is very small and Capillary, and is disseminated into the glandulous and membranous parts about the roote of the eare. There are also other threddey surcles which are spent into the muscles of the larynx or throte, and of the bone *Hyois*. And this is the cause of the consent betweene the eares, the tong and the larynx. Hence also it is that when the auditory nerue is originally and in the first conformation obstructed, those that are borne deafe are also dumbe; and thus much of the lesser part of the nerue.

The thicker part of the nerue which is soft, and is properly the *Nerue of Hearing* because it of it selfe is the cause of this sense; is led through the hole of the foresaide passage and runneth out into the dens or caues of the stony proesse: yet the larger branches doe determine in the first cavity as being the largest and of most vse, where they are dilated like a membrane and make the chiefe instrument of hearing. Wherefore the receiued opinion is, that in this cavity the sense of hearing is especially administred, because into it the animal spirit entreth through the nerue, and is there mixed with the Inbred ayre. Out of this one cavity through small perforations of the fore said cavity run certaine small threds into the other two cavities, which are communicated to the membrane wherewith they are compassed.

The vse of it.

The vse of this nerue is (according to *Galen* in the sixth Chapter of his 8. Booke *de usu partium* & *Auerrhoes* 2. *Collect.*) to be the Organ of hearing, and to receiue the sensible object that commeth from without, and to leade the images of the sounds vnto the braine as vnto their competent Iudge and Censor saith *Laurentius*.

The Chord.

But from a branch of the fourth coniugation of the braine, there departeth a very small surcle, which with a winding passage entereth into the cavity of the Eare neere the bony canale which goeth to the palate, then it cleaueth obliquely to the Tympane, and after to the Hammer about the insertion of the muscle, and proceeding on perforateth the stony bone in the backside of the hole of the hearing: then, a little reflected, it creepeth downward till it meete and ioyne it selfe with a smaller and harder branch of the fift coniugation. This *Eustachius* calleth a Nerue, others call it the chord or thred which, say they, runneth through the middest of the membrane of the Tympane; but whence it ariseth and whither it would, or whether it be a nerue or an artery, they freely confesse that they are ignorant.

Eustachius.

CHAP. XXIV.

Of the Implanted or Inbred Ayre.



Galen in his seventh Booke *de Placitis*, speaking of the instruments of the senses determineth; that the instrument of sight is lucid or bright, that of the hearing aereall, that of the Smell vaporours, that of the Taste moist, and that of the Touch earthy. Wherefore when we say that the instrument of hearing is ayry, or like vnto ayre, we vnderstand that it is a part of mans body (taking the word Part in a large signification) which imitateth the nature and condition of the ayre.

This ayre of which *Plato* among the Philosophers made first mention, is seated in the eares from the first originall of our generation in the wombe of our mothers. I meane as soone as there were emptie cavities hollowed in the bones, all which are filled with this ayre.

And

The objects
of all the senses,
Plato.
How this ayre
is generated.

And therefore the Ancient Philosophers and Physicians, yea *Aristotle* himselfe in the eight chap. of his 2. Book *de anima*, and the 83. text called it *implanted*, or *Inbred*. Others call it *Congent*, *implanted*, *complant* & *inedificated*. It is made of the airy part of the seed and that very pure, to which the purest airy part of the mothers blood applyeth it selfe, saith *Archangelus*.

The names of
it.

This aire is contained in the cavities of the eares; which may be proved, because all the dens and cavities excepting the first in which are the smal bones the muscles & the chord, are empty; seeing therefore there is in Nature no vacuity, it is necessary that these empty cavities must be full of aire.

Where contained.

This aire is thin, pure, without any sound at all, immovable, plentifull and separated from the externall ayre. *Thin and pure*, that it might more readily and more perfectly admit any externall sound, for through a crasse and cloudy ayre the sound is not so freely caried, but heard with more difficulty; whence it is that a mans voyce in winter is baser then in summer, because as saith the Philosopher in the 17. Probleme of the 11. Section, both the inward and the outward aire is thicker in Winter then in Summer, now being thicker it is mooved more slowly.

The nature of
this ayre.

Pure.
Arist. Problem.

This ayre is *without any sound*, and therefore in the night we may hear better because there is no noyse stirring, as *Aristotle* teacheth in the 33. Probleme of the 11. Section. Ad hereto that which he in the same place addeth, that in the day time the ayre is dense, because it is filled with light and the beames of the Sunne, but in the night more rare, because the fire and the beames are departed thereout.

Without sound
Arist. Problem.

Wherefore the outward ayre which is altered by sounds, and like a waue of the Sea boundeth to the eares is not admitted into the inward eare, neither doth it touch the implanted ayre; for if it had, the sense of hearing would haue beene imperfect and the Instrument would soone haue beene vitiated, which *Aristotle* proueth by an instance in those that yawne, in the 29. Probleme of the 11. section, and in his 5. Book *de generatione animalium* and the 2. chapter. For when we yawn we cannot heare so distinctly, because much of the ayre we breath forth getteth into the eares, insomuch that we may sensibly perceyue the motion thereof; for when the internall aire resisteth the occuration of the outward there ariseth a noyse in the eares, which noyse as also the circumaction or disturbance of the spirit hindreth our hearing whilst it be againe appeased.

Aristotle in-
stance.

Why wee can
not heare well
when we
yawn.

Againe, it was necessary that this implanted aire should be *immovable* by it selfe or of it owne nature, that it might exactly receiue all the differences of sounds, of *motions* saith *Aristotle* in the eight chap. of his second Book *de Anima*. Others say, it is immovable because it is not moued by any other but remaineth alwayes the same in the eares. Others because it hath no naturall sound but is fit to receiue all differences of sounds saith *Laurentius*. But that the inward aire ought to be quiet and immovable may be proued by the indisposition we haue in our hearing when we are troubled with hissing or singing noises in our heads. Yet is this ayre mouable not of it owne accord, but because it is moued with the least impulsion of the outward aire and is stirred with local motion; for when the outward aire moueth the membrane of the drum, the internall aire is also moued, that it may receiue a forme like to the forme of the sound which is made.

Immovable.

How it is
mouable.

It is *Plentifull*, for plenty is required for the full reception of the sound; some say that it may be able to receiue many sounds offered vnto it at the same time, but *Placentinus* saith, it doth not receiue many sounds because of the multiplicity of the parts thereof, because each sound is receiued by euery little particle thereof.

Plentifull.

It is *separated from the externall Ayre* by the interposition of the membrane of the Tympane, least the Instrument of Hearing should bee offended. For if the externall Ayre should haue gotten into the inward Ayre; if it had beene eyther too cold or too hot it would haue violated the Auditory Nerue, and by continuity the After-braine also and the Braine it selfe. Moreouer, if the externall Ayre should haue beene immediately ioyned and commixed with the internall, seeing the externall is in perpetuall motion, thicke, impure, oftentimes also smoaky and full of small creatures, it could not haue beene auoyded but that the Hearing would thereby haue bene impaired if not perished; for the inbred ayre also would haue become thicke, smoaky, and also filled with those small Animals. It would also haue sometimes hapned in violent motions of the outward ayre, that the inbred aire and with it the Animall spirit must haue beene shouldred out of their proper place and the hole of Hearing quite rammed vp. Furthermore, this benefite wee haue by the membrane that separateth the externall from the implanted ayre, that if a man bee vnder water, the water cannot

Separated
from the out-
ward ayre.

not

nor pierce into his head or take away his Sense of Hearing, as those Diuers finde by experience, who for Fish or Pearle or any such like occasion doe vse to Diue into the bottome of the water.

The nature of
the implanted
ayre.

Like the ani-
mall spirit.

How nour-
ished and re-
stored.

Simplicius.
Coiter.

A passage out
of Archangelus

What Diadosis
or transump-
tion is.

How the ayre
is nourished.

The vse of this
ayre.

Diuers opin-
ions.

Aristotle.

Mundinus.

Carpus.

Varolius.

Coiter.

Archangelus.

Aquapendens.

Placentinus.

Neither is this implanted aire of the same nature that the outward ayre is of, but hath onely a similitude therewith, which we may gather out of these words of *Galen*. *Neither is euery Instrument of sense changed, altered or affected by euery sensible object: but that which is bright and light some is altered by colours, that which is aery by sounds, that which is vaporious by odors, and in a word that which is like is familiar to his like.*

Wherefore we esteeme the nature of this ayre to be the same with the animall spirit which also is aery, and that there is the same maner of the conuersation and refection of the one and of the other. For this implanted ayre is successiue generated and againe dissipated, as the Animall spirit is continually spent in the animall actions, and againe euery day regenerated. In like maner this ayre that is bred in the eare is (at least a part of it) continually dissipated and generated againe; for if it should altogether be exhausted or spent we should vtterly lose our hearing. Now it is strengthened and hath his refection from the ayre which wee draw in by our nozethrils and through our mouths, especially by that which entreteth at the mouth, for there is a patent and open passage thorough the Canale which we haue before spoken of out of the mouth into the Eares, by which passage also wee sayd before that the Eares were purged.

Simplicius the Philosopher hath deliuered, not that this ayre is like the animall spirit, but that it is a thing animated or hauing a life of it owne, wherby it subsisteth. *Coiter* calleth it a part of the Soule, *Archangelus* conceiueth that it is nourished by blood, whose opinion we will heere set down, that those that list may iudge of it.

The aery body (saith he) is nourished by blood brought by the veines, and that *per Diadosin*, that is, by Transumption, as the cristalline humour of the Eye is nourished by the glassie humor, by this *Diadosis* or transumption. For there redoundeth out of the glassy humor as much as is sufficient for the nourishment of the cristalline, like as the glassy humor transumeth from the membrane called *Araña* or the *Cobweb* an Aliment accommodated and proportionable to it selfe. And this commeth to passe after this manner. In the Coate called *Araña* or the *Cobweb* there are veins by whose blood it is nourished. After the Cobweb is satisfied, that which redoundeth or is superfluous is transumed by the Glassy humor: when the Glassy humor is satisfied with nourishment, that which remaineth is transumed by the Christalline humor as a fit nourishment for it, so that the Christalline is nourished by an Aliment, prepared by the vitrious humor, and the vitrious or Glassy humor is nourished by an Aliment prepared by the Cobweb, to wit, either of the others superfluities or leauings.

The same happeneth in the aery instruments of hearing. For the membrane that inuesteth it receiueth veines and is nourished with their blood: that which aboundeth beside the nourishment of the membrane, being now far altred from the nature of blood is attracted and transumed by that aery body into his proper nourishment. But that this instrument of hearing might haue not only venall nourishment but arteriall life also, and with it all the parts that are subordinate and ministring to it; there are certaine arteries which are deriued into the structure of the organ of hearing. Thus far *Archangelus*.

Concerning the vse of this implanted ayre our Authors are full of diuersity. *Aristotle* in the 10. Chapter of his second Booke *De partibus Animalium* and in the second chapter of his fift Booke *De Generatione Animalium*, calls it *Audiendi sensorium*, the very sense of hearing it selfe. And truly the Ancients haue all deliuered that it is the chiefe and principall Organ of Hearing, and from hence it was that *Aristotle* sayd that the Nature of Hearing was aery.

Mundinus sayth, there is an audible spirit in the cavity of the stony bone which is the instrument of Hearing.

Carpus thus. The implanted ayre receyueth the species or formes which are brought to the sense of Hearing.

Varolius. The included aery spirit is the proper Instrument of Hearing.

Coiter. This ayre is the first and principall organ of Hearing, yea a part of the Soule.

Archangelus. It is the most principall Instrument of Hearing, which the Faculty vseth in the perception of sounds and voyces, and in iudging of them.

Aquapendens. The office of this ayre is to receyue outward and externall sounds, and so it is the principall author of Hearing.

Placentinus. It is the matter which receyueth the Sound, the Medium where-through it is

transported. For after it hath receyued a Sound it doth not conceyue it or iudge of it as being a thing inanimated, now no action of the Soule can be performed by that which is not animated.

Laurentius. This Ayre is exceeding necessary to the Sense of Hearing, without which I can scarcely conceyue how we should heare at all; but that it is the principall organ of hearing, I could neuer be perswaded, especially because it is not animated, but rather I belceue it to bee an internall *Medium*.

Finally our Author *Bauhine* setteth downe the vse of it in these tearmes.

This Aire the faculty of hearing vseth as an internall *Medium* for the susception and transvection or transportation of Sounds and voices to the auditory nerue, by it to bee discerned, like as in all the instruments of the other senses there is required a double *Medium*, the one outward the other inward. Inward, as in the sight the watery humor, in the Taste the spittle, in the Smell the spongy bones, in the Touch the skinne is the internall *Medium*, (although I know *Laurentius* would haue it the Cuticle) in which the formes or *Ideas* of things are separated from the things themselues, and so naked are transported vnto the first *Sensator*. In like maner the implanted aire is gathered in the inward eare, to receiue the abstracted formes of the sounds, and to transport them or conuey them vnto the sense.

Againe, as in all the instruments of the senses the internall *Medium* is distinct, and a differing thing from the principall Organ to which the action particularly belongeth; as in the Organ of sight the watery humor is thought to be the internal *Medium*, but the cristalline the principall part receiuing the representations, but not iudging of them: so in the hearing the internal *medium* is this implanted aire; but the principal part is the auditory nerue, which yet doth not iudge of the *Idea*, but conducteth it to the braine, that is to the first *Sensator*.

CHAP. XXV.

Of the maner of Hearing and of the Nature of Sounds.

Considering that to intreate of the maner of Hearing belongeth rather to a Philosopher then to Anatomists, we will be but brieue herein, yet something we thinke good to say because the structure of the eare was for the most part vnkown to the ancients.

The Eare is the instrument of hearing, and the action of the eare is the sense of hearing; vnto this Sense there are three things required: an Obiect, a *Medium*, and an Instrument. The Obiect is that which is audible, that is, all Sounds. A Sound is a quality issuing out of the Ayre (Coiter addeth, or the water) beaten by sudden and forcible collision or concurrence of hard and solid bodies, and those smooth, concavous and large. This definition we will labor to expaine in this following discourse. The *Medium* is cyther Externall or Internall. The Externall *Medium* according to *Aristotle* is Ayre or Water, but in water the sound is but dull, as a man may perceiue when his head is vnder water: yet they say that Fishes can heare in the water very well, as they can assure vs that vse in the night time to fish for Mullers. And although the ayre going into the water do make a sound; yet this sound is made in the Ayre and by the interposition therof, though it be made by the water.

The Internall *Medium* is the implanted Aire concluded within the denues or cauities of the eares. The Instrument although we may say it is the whole inward eare furnished with his cauities and other parricles aboue expressed, and although that generally the Philosophers and Physitians do determine that the inbred aire is the especiall and proper Organ of hearing; because as in the Eye the cristalline receiueth the obiect, that is, the light: so this inbred aire receiueth the sound. Yet we are of opinion that not this aire but the auditory nerue is the principall instrument. For we thinke with *Galen*, that not only the alteration or reception which is made by the inbred aire is the sense of hearing, but also the dignotion or iudgement of that alteration. Wherefore sounds and voices are transferred by this ayre to the auditory nerue, as vnto the substance that is apprehensue, and from thence to the common sense where they are exquisitly iudged of. For if they must be knowne and perceiued, then must they touch some substance indued with sense, because all action is by contraction. Now the sensatiue faculty is not transported out of the body, and therefore it was necessary that the sound should apply it selfe to the eare.

The Sound is generated of hard bodies mutually striking one another, as of the Efficient

Plecentinus.

Laurentius.

Bauhine.

An inward & an outward *Medium*.

That it is not the chiefe organ of hearing

Three things required to Sensation, Obiect, Definition of a Sound, *Medium*.

3. Instrument.

How sound is made.

ent cause, (for soft bodies doe easily yeeld, not resisting the force that is offered vnto them) and is receiued in the aire as in his matter : this Ayre accompanieth the Sound, and carryeth it as it were on his wings ; for as the ayre is moued so also is the Sound carried as wee may perceiue by a ring of Belles farre off from vs : for when the winde bloweth towards vs wee shall heare them very lowd : againe when the ayre is whiffed another way, the Sound also of the Bels will bee taken from vs. So also when two hard bodies are smitten the one against other, wee see the percussio before wee heare the Sound, for wee do not heare the Sound before the ayre that was moued doe bring the Sound with it to our eares, neither is that motion made in a moment but in time, and is carried swifter or slower as the percussio of the resisting bodyes was more or lesse vehement and quicke (for this the Philosopher requireth in Sounds) and consequently the repercussio or repulse of the aire. So wee see in a Drum if the skin of Vellam be moyst and lax, either they will not sound at all, or they make but a dull noyse.

How the sound
attaineth to
the eare.
A fit compar-
ison,

Vndam vocalem.

The Aer being affected with the quality of the sound driueth and altereth that ayre that is next it, and so by succession till the alterations come to the Ayre that is next to the outward Eare, even as when a stone is cast into the water it stirreth vp circles which driue one the other till the water moue against the brinke, or if the water bee broade doe of it owne accord determine. In like manner by the percussio of the Ayre there are generated certaine circles which moue one another till by succession they come to the organ of hearing: which continuation of the aire thus beaten *Anicen* and the ancient Anatomists call *vndam vocalem*, the vocal waue.

But if the stone be great and violently throwne into the water, so that it driueth the circles vehemently to the brimme of the pond, then will those circles be repelled againe and so run doubled and hudling to the first circles. In like manner if we hallow or speake aloud against any arched place, or against a wood or a mountaine, the voyce will be doubled and an Echo will answer vs.

What aire is
fittest to re-
ceiue a sound.

But all ayre doth not alike receiue a sound. For a pure thin and cleere ayre, which is vehemently and suddainly stroken by two hard bodyes whose superficies is broad, will sooner receiue the sound, and represent it more smartly then if the Ayre or the Bodyes bee not so prepared. A Needle strooke against a Needle will not make a sound though they bee hard bodies, because their superficies is narrow and not broad, and so in the rest. But above all, that Ayre which is containd in a concauous or hollow place, doth best receiue the species of soundes; because in the reflection there are many percussions besides the first; for the reuerberation of the Ayre maketh much for the increasing of the sound, which wee may see in dens, caues, woods, hollow mountaines, wels, and such like, which will not only returne againe the soundes that they receiue, but sometimes also the very articulated words. And thus much concerning the nature and generation of soundes, which is a meere Philosophicall disquisition, and therefore we passe it ouer more briefly. Now let vs come to shew how the outward Ayre that is beaten, is communicated with the implanted Ayre and the internall parts.

Diuers opinions
of the manner
of Hearing.

1. *Empedocles.*

But before we descend to this it shall not be amisse to let you take a view of the diuers opinions as wel of the Ancients as of the Moderne writers, concerning the manner how hearing is made, for vpon that very point we now are.

The first is that of *Empedocles*, who thought that this sense of hearing is made because the aire offereth a kind of violence to the inward part of the Eare, for because the inward Eare is intorted like a winkle-shel, and hangeth as a Bel in the steeple of the Body, it easily perceiuerth all appulsions of the aire.

2. *Alcmeon.*

The second is that of *Alcmeon*, who thought that we therefore heare because our Eares are within empty, for all empty things do resound if the sound get into them.

3. *Diogenes.*

The third is that of *Diogenes*, who saith, that in the head there is an aire which is smitten by the voice and so moued: against whom *Hippocrates* writeth in his Book *de carnibus*, where he saith, that there are some Authors of Naturall Philosophy, who affirme that the Braine yeeldeth a sound, which cannot be. For the Braine it selfe is moist, now no moist thing wil resound, but that onely which is dry.

4. *Hippocrates.*

The fourth is the opinion of *Hippocrates* in his Booke *De locis in Homine*. First of all saith hee, the Eare is perforated, and in that part wee heare, yet the emptie places about the Eares doe heare nothing but a confused noyse, but that which entereth through the membranes into the Braine, that is distinctly heard; where there is a perforation through the membrane

membrane which inuesteth the Braine. And in his Booke *de carnibus*, we heare because the holes of our Eares reach vnto the dry and stony bone to which is added a canale or fistulous cavity, against which hard bone the sounds do beate, and the hollow bone because of his hardnesse yeelds a resonance. Now in the hole of Hearing neere that hard bone, there is a thinne Filme like a Cobweb the driest of all the membranes of the body: but that which is the dryest is fittest to conceiue or receiue a sound as may bee prooued by many arguments. When this Membrane therefore yeeldes the greatest resonance then wee heare best.

The fift is *Platoes* opinion. The ayre that is implanted in the eare is beaten, that pulsation is transmitted into the principall seate of the soule and so we heare. *5. Plato.*

The sixt is *Aristotles*. Wee heare (saith he) when the ayre is mooued by two solide bodies, that which is beaten hath a plaine superficies that from thence the ayre might result; the concussion of these two bodies must bee vehement, that the ayre betweene them may not diffuse it selfe, but bee apprehended and smitten before his dissipation, for so onely the sound resulteth and filleth the ayre by continuation euen to the eare. Now in the organe of Hearing there is a certaine implanted Ayre. Hence it commeth that when the externall ayre is mooued the internall receyueth therefrom a motion and agitation (which otherwise of it selfe is immouable) so as it exactly perceyueth all the differences of the motion of the externall ayre. Thus is the Hearing begunne and perfected in the Ayre. *6. Aristotles.*

Seauenthly, *Galen* in the sixt Chapter of his eight Booke *De vsu partium*. It was necessary (saith he) that from the Braine a certaine surcle should be propagated downward to the eares, which might receiue the sensible obiekt comming from without, whether it were voice or a sound made by the percussion of the ayre; for the motion that is caused by such percussion diffuseth it selfe like a storme of winde or raine, or like a waue of the Sea till it ascend vnto the Braine. *7. Galen.*

Thus far the Ancients, who most of them, if not all, were ignorant or at least much to seeke in the exact Anatomy of the Eye. Among the later writers *Vesalius* and his adherents haue it thus. *8. Vesalius.*

A Nerue of the fift coniugation proceedeth through a torted and writhen passage, and extendeth it selfe into a Membrane where-with the hole of the eare is stopped, which Membrane being thin, dry, and well stretched and beaten by the outward ayre maketh a sound, being assisted by the hardnesse of the bone and his turning gyrations much like the shell of a Snaile or Periwinkle.

Columbus. So also we heare by the help of a nerue of the fift coniugation, which at the middle of the Labyrinth becommeth thicker, but yet maketh not the Membrane.

Massa saith, that the sound is made by the motion of the small bones, and thence wee heare. *9. Massa.*

Volcherus Coiter. The outward Ayre affected with the quality of the sound runneth vpon the Membrane or Head of the Drumme, which when it is beaten mooueth the small bones that are tyed to it. The bones strike the Nerue that runnes ouerthwart the Membrane. The same Nerue makes a repercussion vpon the membrane, whence it is that the ayre included receyueth the alteration and the sound. The Sounds without any disturbance are carried through the contorted Meanders of the Eares to the Auditory Nerue, which receyueth the Image of the noise, and presenteth it to the principall Sensor. *10. Coiter.*

Laurentius hath almost the very same in substance. The outward ayre (saith he) being stricken by hard and solide bodies and affected with the quality of the sound, alreth the ayre that is next vnto it, till by a continuation it come to the eares, where it first encountereth with the Membrane: the Membrane being stricken mooueth the three little bones and transmitteth in a moment the liuely Character of the sound, which Character is receyued by the implanted ayre, and through the windowes it sendeth it through these crooked and winding Labyrinths into the Snaile shell, from whence it arriueth at the auditory Nerue, and from thence is conueyghed to the common Sense as vnto an equall iudge or Censor. *11. Laurentius.*

Archangelus hath it on this manner as neere as I can vnderstand him. The thing that maketh the sound sealeth or stampeth in the ayre the species or forme of the sound, and withall driuerh it on vnto the Instrument of hearing which is also ayery that it might better receiue those species, and must likewise be mooued; wherefore the hole of the Eare standing

ding alwayes open (& in his inside supporting the stretched membrane of the tympane, behind which the aery instrument of hearing is concluded or shut vp, and to which the Anuile cleaueth) when the outward ayre attaineth to that membrane the Hammer beateth vpon the Anuile, and so it commeth to passe necessarily that the Instrument of Hearing (by which he vnderstandeth the implanted Ayre) is moued with the same motion that the outward ayre is moued, whence it is that altogether the same species or similitude of sound moueth the Faculty of hearing, which is brought thither by the outward ayre. Now the Nerues of Hearing do determine into the same place where this aerie instrument of Hearing is concluded, and a membrane made of the amplification of these nerues encompasseth that aery body, as the Opticke Nerues doe ariue at the Christalline humour. And as the Opticke Nerues do conuay vpon the wings as it were of the Animall spirit from the place of the Common sense the *Visine* Faculty to the Christalline humor: so these Nerues from the same Common sense doe transport the Faculty of Hearing to the principall organe of Hearing, that there might be a perception made of audible things. And so the Hearing when it hath apprehended the sound of an audible thing carrieth it to the Soule, and then the Reason or the intellectuall or sensatiue Soule comprehendeth and taketh knowledge of that which maketh the sound to be a Bell or a Drumme, or any other thing.

13. *Banquine.*

Finally, *Banquine* my Author (I call him so often my author to stoppe their mouths who would thinke that I should arrogate too much to my selfe if I should not acknowledge him from whom I haue taken most of this History) expresseth it on this manner.

The outward Ayre is an externall *Medium* which being driuen and moued by the mutual percussion of two hard bodies and affected with the quality of the sound, carryeth the sound which resulteth from that percussion vnto the Eare. The sound passeth through the hole of hearing which is alwayes open vnto the Membrane of the Tympane which it moueth.

That Membrane being moued, the implanted or in-bred ayre is also moued and receiueh the sound, or at least his Character or impression, and transporteth it out of the first cavity of the stony-bone thorough the hole of the Stirrop and the *Ouall window* to the other two cavities which we called the *Labyrinth* and the *Snayle-shel*. From thence it is conueighed to the auditory Nerue and to the originall thereof, that is the After-braine and so to the common sense as vnto a Iudge that is able to determine of the differences of sounds.

And because the Auditory Nerues are ioyned in the *Bridge* of the After-braine from whence they proceed, therefore all sounds are apprehended in one comprehension, not in two though there be two eares, that is, two organes of Hearing. But least the Membrane before mentioned should be driuen too much inward by the violence of the outward ayre when it is violently beaten, Nature prouided three small bones and two Muscles as we haue shewed before to preuent that inconuenience.

The vse of the hearing.
Aristotle.

The vse of the Sense of Hearing according to *Aristotle* in his Book *De sensu & sensibili* is to acquire or get knowledge and wisdom. For speech being an audible thing is the verie Cause of Learning. Again by the Hearing things are signified to our selues, as by our voice and tongues we are able to signify any thing to another, as *Aristotle* hath well obserued in the end of his third Booke *de Anima*.

A deprecation

And so much shal haue bene sufficient to haue spoken concerning the Sense of Hearing, wherein I finde that I haue great cause to entreate my Reader sanably to reade ouer this Discourse, and to pardon me if in some things I haue not so fully satisfied him; for there are some passages in my Author, wherein I haue bene intangled, partly by the difficulty of the matter, partly by the fault of the Printer, for in such a case as this the least error may prooue a sufficient *remora* or obstacle to interrupt the tenor of a Discourse, but as neere as I could I haue followed their words, at least their meaning, if they vnderstood themselves, as of some of them I make much doubt.

CHAP.

CHAP. XXVI.

Of the Nose which is the instrument of Smelling.

HAving absolued the Historie of those many particles which belong vnto the sense of hearing, wee will now come to the third outward sense which is the Smelling. As therefore we said in the Eare that there was an outward Eare and inward Eare; so must we also diuide the Nose into an outward and inward. The outward Nose carryeth with it, saith *Laurentius*, a kind of beauty, yea of maiestie; and the *Egyptians* in their *Hieroglyphicks* signified a wise and prudent man by a nose: and *Festus* calleth such wise men *Nasutus*, as if they were able to sent or smell the politicke stratagems of other men. Besides man, onely those creatures haue this outward Nose that haue foure feete and bring forth liuing ones, as for birds and serpens (saith *Aristotle* in the 16. Chapter of his second Booke *de partibus Animal.*) and those foure footed beasts that lay egges, they haue onely *μυστήρια*, holes of the Nose, which are not so compassed or formed that you may call them Noses; vnlesse it be because they breathe and smell by them. As for those Creatures which doe not breathe, they haue no Nose or holes at al, but other instruments of this sense, some smell by their gills, some by their *fistula* or pipe or trunke, some otherwayes as some of those we call *insecta*.

The outward
vie.

Nasutus.

Aristotels.

This outward Nose is called *πίρ* by *Aristotle* in the 11. Chap. of his first Booke *de Historia Animal.* and in the 16. Booke *de partibus Animalium*, as *Galen* in his Booke *de olfactus instrumento*. The word seemeth to be deriued from *πίρ*, because through the Nose the excrement and superfluities of the head doe fall away. Others call it *μυστήριον*, because of the mucous matter or phlegmaticke excrement which distilleth through it. If we should describe the Nose, we must say that it is a protuberating or strutting part of the face, making a way for the Ayre, for by we receiue it in and auoyde it out againe: some say it is a defence for the instruments of smelling, when as indeed they are not contained in the Nose, but remaine within the skull. Yet we will not deny but that it is an assistant to them, for if the Nose were away we should not smell without all question.

The names.

The reason of
the figure.

It is scituated betwixt the Eyes, for the part whereby we breathe ought to be in the midst and before. Nature therefore placed it in the midst betweene three other senses, the Sight the Hearing and the Taste, and in a straight line that the respiration might not bee interrupted but passe freely to and fro.

And situation

Moreover it is placed saith *Cicero* in his second Booke *de Natura Deorum*, aboue; because Odours flie vpward and therefore from aboue are more commodiously receiued. Add hereto that it standeth vs in good steed to smell our meats and drinks being so neere the mouth, which instinct Nature hath giuen also to brute beasts, as we may see especially in Apes who first smell to a thing before they will eate it. In a man the chiefe vse of the position of the Nose is for beauty and elegancy.

The Basis of the Nose aboue is broad and groweth into a blunt end downwards or rather, saith *Laurentius*, it beginneth with a sharpe point from the inward Angles or corners of the eyes, and endeth at the beginning of the lips.

It is diuided into an vpper part which is immoueable and bony, and a lower, which is moueable and gristly. The vpper part of the Nose called *Dorsum* or the backe is called in Greeke *πίρ* the spine or ridge of the Nose. The lower part where it enlargeth it selfe, into the Nostrils is called *ακρίον* by *Ruffus* and *Pollux*: the foote of the Nose, and the vtmost roundnesse *σφαίριον* the globe of the Nose or the tip as we commonly speake.

The diuision
of the nose.

Within it is diuided into two cavities by a hedge or partition which they call *pteryges*, *mares* the Nostrils, because in them the odors or odoriferous spirits or the Ayre doe innare or swimme continually; others cal them *μυστήρια* of the mucous matter that yssueth from them, others *τὸν πύλον τῶν ὀσφύων*, the holes of the Nose as *Galen* hath in his Booke *de instrumento Olfactus*.

And the names
of the parts.

The vse of the diuision is, that the action of the smelling might be more perfect, for in all the parts of sense (excepting the Touch) the sense is bipartite, because of the two sides of the body, the right and the left.

The vse of the
diuision:

In like manner saith the Philosopher in the 10. Chapter of his second Booke *de partibus Animal.* the power of the Nostrils is double or bipartite, but if they had bin disseuered or set aside as the eares they could not haue performed their office; because we smell euen in

our breathing, as also doe all other creatures which haue nostrils. Againe, by reason of this diuision one nofethrill remaines open when the other is obstructed, that thorough it we might haue the benefit of Inspiration and Expiration, and when both of them are obstructed the mouth may bee opened to supply their office, as wee see often in our Patients whose noses are stopped with a cold, they sleepe with their mouths open, drawing and yeelding their breath thereby least the man should be strangled.

The diuision
of each hole.

It is further to be noted that the holes of both the nostrils (which is but one in one nostrill) about the middle of the Nose are deuided into two parts, as *Galen* obserued in his Booke *de Odoratus organo*. The one part runneth aboue the palate into the vtmost part of the mouth and throate, whence it is that oftentimes we see that if a man laugh when he is drinking the drinke will come out at his nofethrills: and those Irrhines which wee cast into the nose sometimes for medicine, will fall into the mouth if the nose be close shut. The other part of the hole of the Nose ascendeth to the spongy bone. Finally, the outward parts of the Nose which compasse the holes are called *πτερυγια ala, pinna*, The wings of the Nose.

The Nose consisteth of a Cuticle, a Skinne, Muscles, Bones, Gristles, and the inward Coate.

The Skin.

The Skinne wherewith it is couered is thin, without any fatte that the quantity of the Nose might not exceed, which would haue beene a great deformity; but vnder the partition in the middle of the Nofethrills there is a rising or prominent fleshy particle neare the top of the lip, called by *Ruffus* and *Pollux* *κίον Columna* the Pillar, which in some men hangeth something outward; it is thicke and fungous so that it resembleth the Cartilage or Gristle, (from which notwithstanding we must learne to distinguish it) and in the compasse thereof stand many haire called properly *Vibrissæ*, becaute when we twitch them out it maketh vs shake our heads and sneeze, which is called *capitis vibratio*. The vse of these haire is, that those small Animals that fly about in the ayre should not be drawne into the nose in our Inspiration, but hang in those hairy springes.

The haire.

The muscles.

But becaute in deeper and sudden Inspirations and Expirations the motion of the nostrils serueth to no small purpose, therefore Nature made them mouable, and becaute they were to be moued according to our will and good pleasure, there are certaine muscles inserted into them, some seruing for dilatation, others for contriotion: the first open the nofethrills, the other shut them. Those that dilate the nostrils are foure: two small ones arising from the cheeke-bones, two others arise from the seame of the fore-head. There are also other foure which constringe the nose, two arising from the rootes of the wings, the other two are hidden in the cauity of the nose, vnder the coate which compasseth it about; but of these we shall heare more particularly in the Booke of Muscles.

CHAP. XXVII.

Of the Bones, Gristles, Vessels, Coate and vse of the Nose.

The bones.



He Bones which make the cauity of the Nofethrills are of two sortes: some may be sayed to be proper to the Nose although they be bones of the vpper Iaw, others are common. The proper are three: two externall and one internall, and these reach from the top but to the middle of the Nose, the rest is gristly.

The gristles.

The common Bones are one fixed at the vpper roote of the nose within, called *σπογγώδης* by *Hippocrates* and *Galen*, and neare it wee finde two other fungous and spongy bones which fill the vpper cauity of the nostrills made for the voyce and the Reception of odours, which are vnited by the bone *Cribri-forme*, so that some thinke them to be parts thereof: but of these in the History of the Bones.

Vessels.

The Gristles of the Nose are five: three are before tyed to the circumferences of the bones, and two make the wings, of which we shall intreat amongst the Gristles.

The coat or
membrane.

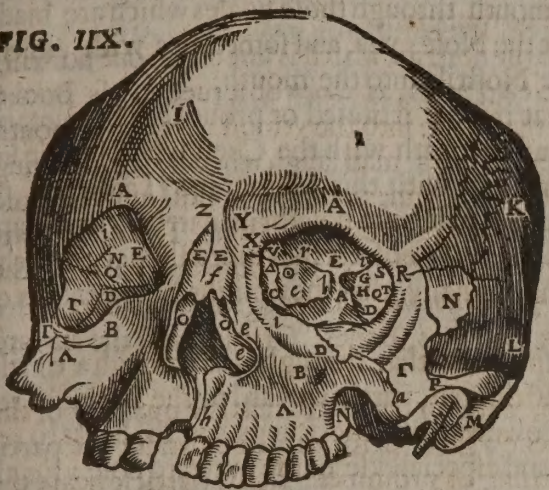
The vessels of the Nose are veines from the Iugular veines, arterics from the sleepe arteries, and nerues from the third coniugation of the braine on eyther side one.

The Coate (which *Galen* in his Booke *de instrumento olfactus* calleth sometimes a coate sometimes a membrane, but a membrane most Anatomists call it) which compasseth the capacity of the nostrills is, as *Vesalius* thinketh, an extension of a branch of the lesser rootes of the third coniugation of finewes. But *Columbus* and *Bauhine* take it to arise from the *Durameninx*, and it is the common coat of the mouth, the palate, the tounge, the *Larynx* or throtle,

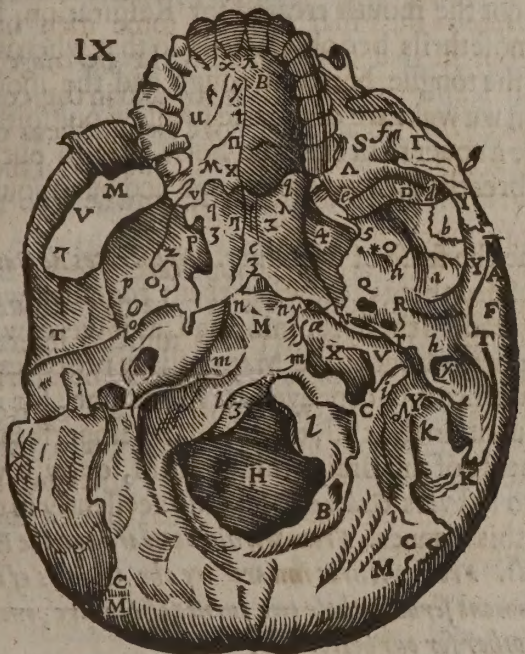
Table 12. Fig. 8. sheweth the fore-side of the Skull, as also the bones, the holes or perforations and the Sutures both of the skull and of the upper Jaw: Figure 9. sheweth the Basis of the Skull, and many holes and Sutures therein.

TABVLA XII:

FIG. IIX.



IX



- AA*, A hole in the fore-head bone.
BB, The hole of the fourth bone of the vpper iaw, which is in the cheek.
C, A hole of the second bone of the vpper iaw in the inward angle of the eye.
DD, The fourth hole of the Wedge-bone in the outward side of the eye.
EE, The first hole of the same bone.
G, The second hole.
H, The third hole of the same bone in the scate of the eye.
II, The fore-head bone.
K, The left bone of the *Synclipter*.
L, The left bone of the temples.
M, The Mammillary proceffe of the temples.
NN, The Wedge bone.
III, The first bone of the vpper iaw.
Δ, The second bone of the vpper iaw.
Θ, The third.
ΛΛ, The fourth in the left eye.
Ξ, The fift bone of the vpper iaw in the Nose.
OO, The bridge or partition of the nostrils.
P, The Suture in the yoke bone.
Q, A part of second common suture from the first *N*, to *S*.
RSTVXTZ, The third common Suture drawne obliquely through the orbe of the eye.
aD, The first externall suture of the vpper iaw in the cheek, and from thence through the eye to *Q*.
b, The third externall suture of the vpper iaw from *b*, to *c*.
c, The second externall suture of the vpper iaw in the eye.
e, The fourth externall suture reaching to *z*.
f, The first externall suture of the vpper iaw in the middle of the Nose.
g, The second internall suture in the nose.
h, The seauenth externall suture of the vpper iaw.
i, A bastard suture of the vpper iaw at the eye.
Fig. 9. A, The end of the Coronall Suture.
CC, The lower additaments of the Lambdall suture on either side.
D, the fourth hole of the wedge bone in the outside of the orbe of the eye.
F, A part of the fourth proper Suture.
H, the great hole of the *occipitium* made for the spinall marrow.
K, A part of the bone called *Synclipter*.
LL, A part of the fore-head bone.

MM, The lower part of the nowle bone. *N*, A rift or cleft of the wedge bone which is common to the bones of the temple, drawne on the left side from *v*, to *o*. *OO*, The wedge bone. *P*, His foure processe marked 2, 3, 4, 5. *AR*, The first hole of the wedgebone at the bottome of the throat. *A*, the seuenth hole of the same at *R*. *T*, The first bone of the vpper iaw. *SA*, The fourth. *π*, The fift, where the Cutter betwixt *e*, and *π*, hath not well expressed the Suture. *TT*, The bones of the Temples on either side. *V*, The fourth hole of the bones of the temple made for the hearing. *z*, The bridge or partition of the nose. *X*, The first hole of the temple bone in his Basis. *YY*, The yoke bone. *aa*, The anterior part of the fourth proper Suture. *b*, The lower part of the fift proper oblique Suture. *c*, The lower part of the bridge of the nose which is like a Coulter where 3, is placed. *d*, The vpper part of the second common Suture. *f*, The First externall Suture of the vpper iaw in the Cheeke. *g*, The first common Suture in the side of the brow. *h*, The cavity of the Temples whereto the lower iaw is articulated. *i*, The Appendix of the Temple bone called *Stylodes*. *k*, The mammillary proceffe of the same Temples. *ll*, the knob of the nowle bone. *mm*, the 6. proper oblique Suture of the scull. *nn*, the seauenth transuerse Suture. *op*, A Line beginning from the last named Suture which climbeth by the Temples, and is more like a diuision then a line. *qq*, the lower part of the second common Suture of the scull in the hollownesse of the nose. *r*, the line of the hole of hearing. *sa*, the stony Bones. *sv*, the 5. externall transuerse suture of the vpper iaw. *Xy*, the 7. externall right Suture. *ab*, A Bastard Suture of the vpper iaw in the palate. *γ*, the hole of the eare. *δ*, the fift hole of the temples neere vnto his proceffe where *r*, should be blotted out. *B*, A hole of the bone which is not alwayes found. *E*, the second hole of the nowle bone made for the first coniugation of the sinnewes, and for the iugular veine and artery. *H*, the First hole of the *Occipitium* or nowle nose. *μ*, two holes in the marrow. *3*, the third hole or the outgate of the seauenth coniugation. *αα*, two holes of the bone for the passage of the palat which is accounted the fourth of the wedge-bone. *ξ*, Fiue holes in the basis of the wedge-bone. *v*, the hole of the fourth bone of the vpper iaw in the palate. Note that *MF*, at the right side pointeth out the cavity which the yoke bone maketh for the passage of the temporal Muscles.

throttle, the gullet and the stomacke. This Membrane although it compasse the whole circumference of the mouth and the parts conteyned in the chops, yet is it one and continuall, and of one and the same substance, but not alwayes of a like thicknesse. For in the Nostrils it is thinner, but in that part which is vnder the spongy bones it is thicker and full of small holes, through which the thicker Excrements of the Braine do passe: which excrements as they descend doe part of them passe into the mouth through those hoales which are made out of the nosethrills thereinto; part yssueth at the Nose, yea, and sometimes with violent hawking we fetch part out of the wayes of the Nostrils into the mouth.

Why we sneeze
when our nose
is tickled.

This Membrane is of exquisite Sense, so that if it be irritated or prouoked, Steruntation or Sneezing will follow, because of the consent it hath with the Chest whereinto it insinuateth selfe: but why were the nosethrills inuested with this Membrane? I answer, to hinder the growth of flesh in the nose which might make the nosethrills narrow, as it happeneth in the disease called *Polypus*. Againe, to make the nosethrills more slippery that the mucous excrement might more easily descend. Finally, that they might be partakers of Sense.

The vses of the
outward nose.

The vse of the outward nose is first for Respiration, that through it as through a canale or pipe the ayre might be conueyed in to be distributed, partly vward to the Braine to recreate and refresh the Animall spirit, partly downwards to the Lungs and the heart to refrigerate and coole the same. This is the first and especiall vse of the outward nose: for although we respire also by the mouth, yet was not the mouth created for Respiration, because if the holes of the spongy bones or the nosethrills bee obstructed (so that when wee sleepe we draw in our breath by our mouths) the tongue becomes rough and the mouth dry (sometimes also it growes bitter) that when we wake we can scarce swallow our spittle. Hence it is, that Nature prouided the nose like a couer to defend the holes that go out of the nostrils into the mouth through which we breath when we are asleepe and our mouths shut vp.

That the
mouth was
not made to
breath by.

The seconk vse of the outward nose is to serue the sense of Smelling. *Hippocrates de Carn.* faith: The moyst Braine smelleth the odors of dry things, drawing them together with the ayre through gristly bodies. For the nose leadeth the ayre, informed, as it were, with the formes of odors through the holes of the Spongie bone to the Mammillary processes as vnto the principall organs of smelling, from whence it is conueyed to the braine: for if a mans nose be cut off at the roote, eyther he cannot smell at all, or at least but imperfectly.

Galen.

The third vse is, that through it the excrements of the Braine might distill, or by a vehement efflation be blowne out. And these two last vses *Galen* expresth excellently in the sixt Chapter of his 8. Booke *de usu partium* on this manner. *From within outward are the Excrements of the Braine deriued through the Nostrils. From without inward are the Obiects of the smelling Faculty transported this way. One Instrument serueth these two turnes of Nature; one of which is necessary for the preservation of Life, the other for our better life.*

Finally, the Nose serueth to forme the voyce, and addeth a great beauty to the Face.

CHAP. XXVIII.

Of the Inward Nose and the manner of Smelling.



That the Nose is the Instrument of Smelling all men will confesse, but because it is compounded of many and diuers parts, it is a great question to which particle among all the rest the *Action of Smelling* is to be attributed. Of these wee haue already examined those parts which make the outward Nose, it remaineth therefore that we prosecute our History in the parts of the Inward Nose.

The inward
nose made of
two parts.

The spongy
bone.

The Inward Nose therefore consisteth of two parts, the bone called *Ethmoides* or rather the spongy bone, and the Mammillary processes. The Spongy bone is situated partly in the top of the Nostrils, partly within the Scull. It is a couering of the Mammillary processes thrilled full of holes or rare and Spongy, through which perforations the ayre is immediately conueyed to the Braine for respiration, and vapors for the distinction of odours: that way also the whole source of the excrements is conducted.

The Mammillary processes which make the other part of the inward nose do proceede out

out of the Braine and haue their habitation within the Scull about the cavity or bosome of the spongy bone. Of this spongy Bone we haue sayd somewhat already in the 6. Chapter of the 7. Booke, and shall speake afterward more at large, and concerning the *Mammillary* processes we haue intreated of them sufficiently in the 16. Chapter of the 7. Book, whither we referre the Reader, and proceede to discouer vnto you the manner of Smelling. And because I would not haue you think that *Hippocrates* was ignorant from whence this Sense came and where it was accomplished, you shall giue me leaue to relate vnto you a short passage or twaine out of his workes. The first in his Booke *de Carnibus*, where he speaketh to this purpose.

2. passages out
of Hippocrates.

The Braine hath in it a Faculty of Smelling though it be moist, and draweth through gristly bodies which are dry, together with the ayre the odours of dry things. For the Braine reacheth euen vnto the cavity of the Nose, hauing no bone in his way but onely a soft gristle like a sponge, which you can call neither a Bone nor Flesh. If therefore the cavity of the Nostrils be dry, then doeth the brain better and more exquisitely perceiue the odours of dry bodies. For it cannot smell water because it is moister then the braine, vnlesse it be corrupted. In like manner when the Nostrils are moist wee cannot smell, because at such times the braine doth not draw the Ayre into it selfe.

Againe in his Booke *de locis in Homine*. There is no passage tending vnto the Nose (hee meaneth the Sense of Smelling) but a loose and spongy substance, and that is the reason why we heare further then we smell, for if the Sense be far from the Sense it is dispersed before it attaine thereto.

Galen more distinctly (as being better acquainted with Anatomy) on this manner in a particular discourse of this subiect. *The Braine sendeth out two sprouts long and hollow, taking their originall from the foreward ventricles and determining at that part of the Scull where the Nose beginneth, where are placed certaine Bones called Ossa Ethmoidea, that is, like a Syue or Searce. But we returne to the manner of Smelling.*

According to *Aristotle* there are three things required to euery Sense; an Obiect, a Medium and an Instrument or Organ.

3. things re-
quired to sense
The Obiect.

The Obiect here are odours or vapours of a fire Nature.

But what an odour is, is not so well knowne as what a Sound or a Light, or a colour is: wherefore in men this Sense is the dullest of all the rest, as *Aristotle* sayeth in his Booke *de Sensu & sensibili*, and many creatures Smell a great deale more exquisitely then we; we touch more exquisitely then any other creature, at least that Sense in vs is most perfect. Whence it is that a man receiueh no Smell without pleasure or discontentment, because the Instrument is not perfect.

The Sense of Smelling is the middle Sense, for there are Fiue Senses, two that worke by contact, as the Touch and the Taste; and two that apprehend their obiects by the interposition of an other, as Sight and Hearing.

Smelling the
middle sense.

Now because Odors are not so manifest (saith *Aristotle* in the 9. Chap. of his second book *de Anima*) as Sapours (for our Language vseth the word Saviour promiscuously in both these Sences) therefore it is that the names of Odors are taken by a similitude from saviors, so that some odors are called sweete, as that of Saffron and Honny; others sharpe as Tyme and such like; there is also a fowre Odour, an acute and a fatte. Wherefore *Galen* in the 22. Chap. of his 4. Booke *de simpli. medic.* teacheth vs that Odors do moue the Taste as saviors doe; for if our meates be corrupted the Taste is able to find the vnpleasing odour, and wee throw them away. Yea almost in euery thing the smel and the Taste haue a mutual consent; wee say almost, because in those things that are most fragrant and sweete smelling as is a Rose, the Smelling and the Taste doe much differ. For the smel is delighted with the Odor of the Rose, but the savor thereof disturbeth the Taste. But as the Hearing is audible and inaudible, the Sight visible and inuisible, so also the Smelling is odorable (for it is no treason to Coyne words in so vnouth a tract of speech) or inodorable. That is inodorable, eyther that hath not nor can haue any odor, or that which hath but a little odor, or that which hath an euill or offensive odor, and so much of the Obiect.

Whence odors
haue their
names.

The consent
betweene the
smell and the
taste

The Medium by which we Smell is the Ayre or Water. For those creatures which liue in the water whether they haue blood or no blood, are yet apprehensie of odours, as also those that liue in the Aire. For Fishes and Snayles and those we call *insecta*, do smell their nourishment a farre off, and approach thereupon vnto it, because of the Alimentary species of the odour, as Bees will flock to Honny, and so in the like.

The medium
of the smell.

But man neuer smelleth but when hee draweth in his breath, for if hee hould his breath,

How a man
smelleth.

That vnbloo-
dy creatures
do smell.

breath, though you put odoriferous things into his Nose he cannot smell them; the reason is, because the instrument of his Smell is not placed in the superficies of the coate of his nostrils, but farre within, to which there are certaine perforations that leade. Againe, in inspiration the instruments themselues are dilated, which if they were not dilated the ayre could not passe through the pores nor ascend vnto the processes and so vnto the ventricles of the Braine. Other creatures, euen those that are without blood do smell, though they do not respire, and they smell because they are able to receiue and *perceiue* odours. And that they do *perceiue* odors, it is manifest, because they are stifled with those odors, where-by men are also stifled. For saith *Aristotle* in his Booke *de sensu & sensibili*, as men get a stuffing in their heads, yea are sometimes suffocated with the steame of Charcoales, so many insectile creatures are driuen away with the smell or vapour of Brimstone or other Bituminous matter, because they are annoyed, yea killed by them.

Hence it followeth that the instrument of smelling in men differeth from the instrument of smelling in such creatures, as a mans eye differs from the eyes of those creatures which haue hard eyes. For those creatures that haue soft eyes haue also eye-lids to cover them, which lids, if they do not moue and open they cannot see, but those that haue hard eyes haue no lids at all, nor any thing proportionable thereto, but they see immediately that which is to be seene.

A difference of
this instrument.

In like manner saith the Philosopher, in those creatures which doe not respire the chiefe instrument or Organ of smelling hath not couer at all no more then their eyes haue. But those creatures which draw in ayre haue their organs of sight and hearing couered; yet because in their breathing their veines and passages are distended, the instrument is vncovered, or it may be their breath remooueth the couering away, but when they doe not respire they cannot smell, which is all otherwise in those creatures that doe not respire. Hence it is that those creatures that doe respire cannot smell when they are vnder water, for they must respire when they smell; but in the water they cannot respire.

Aristotles conceit
of the couers
refuted by
Galen.

This conceit of *Aristotles* concerning the couers of the holes of the nose, *Galen* in his booke *de instrumento olfactus* refuteth. For saith he, it is an vncertaine thing which cannot be demonstrated nor made eident, that we should assuredly beleue it to be true: beside, saith *Galen*, it is of no vse.

But let vs grant that in the bottome of the Nose there is a couer which is opened by inspiration, that the way may be made open for the ayre and vapors to passe in; and that when the inspiration is ended, it againe closeth: It must needs be that the motion of this couer (saith *Galen*) must be Animall or Naturall or Violent.

That it is Animall or voluntary no man will say, because there is no neede of a couer or valve for Animall motion; beside Animall motion followeth our wills, but this couer is neuer opened sauing when we draw our breath. Againe, the instrument of Animall motion is a muscle, but in the top of the nose on the inside there are no muscles.

Neither is this motion Naturall as is the motion of the valves of the heart, because the motion of the Heart is perpetuall and not at our command.

An instance
out of *Galen*.

Violent we cannot say it is, for then (saith *Galen*) when the Ayre rusheth forcibly in, the couers should be opened euen without attraction or drawing of our breath; but this we are able to disproue. For put a man into a chamber fulfilled with some strong odour, and moue the Ayre neuer so vehemently, or leade the smell into his nostrils with a reede (for so doubtlesse those couers if there were any would be refferated) yet he will not sent the smell at all, vnlesse he draw in his breath. Concerning this matter, he that desireth further satisfaction, let him reade *Galen* diligently. We will proceede vnto the third thing required to sensation, which is the Instrument.

The instru-
ment.

Concerning the instrument of Smelling we haue before related the opinion of *Hippocrates*, of *Aristotle* answered of *Galen*, and also by *Galen* himselfe. But the truth is, saith *Archangelus*, that all the ancients were ignorant of this Mystery.

Amongst the latter Anatomists *Varolius* hath well described it, so hath our Author *Ban-
bine*, you shall heare both their conceits.

Varolius.

Varolius hath it thus: Two nervous productions proceed out of the very middest of the Braine, wrought as it were out of the substance thereof; these productions shooting forward doe determine at the top of the nostrils and make the chiefe instrument of Smelling, to which place when the odoriferous exhalations doe attaine, the instrument *perceiveth* the species of the odor without any matter, and into this species is changed; the exhalation is dispersed or extended through the substance of the Braine.

BAN-

Bauhine hath it thus : As the Eye is the instrument of the Sight, and the Eare of hearing, both of them compounded of many particles : so the instrument of the Smell is the Nose. But because in every sense there is one principall part, it is a great question which is here the principall instrument by which the faculty taketh knowledge of the proper objects of this sense. Some thinke it is the Nose, because if we shut our Nose and draw in breath through the Mouth we doe not smell at all, but if we draw our breath through the Nose, the odour presently striketh the sense. But because there are some creatures that smell without Noses, it followeth that the nose is not the principall Organe but helpeth the perfection of the sense, and is an assistant onely to the principall organe. We must therefore finde out some other part, and that in the Nose or neere vnto it.

Bauhine.

The principall instrument.

Not the Nose.

Galen.
Not the bone.

Not the membrane of the Nose.

Not the palat.

Not the Spongy bone.

But the mammillary processes.

Their nature.

Archam. conceit of Nerves of Smelling.

Bauhine.

Odors consist in exhalation.

We

The Bone it cannot be, saith *Galen* in his Booke *de Instrumento olfactus*, because bones are insensible every way, much lesse can they distinguish of smells. It is not the coate or membrane of the nose that discerneth odours; for though you fill the nose with odoriferous things, yet we do not smell before we draw our breath. Again this coate is very like that membrane that inuesteth the vtmost part of the head, which membrane partaketh not of this sense, and therefore not this coate of the nose. It is not the coate of the Palate, of the Chops, or the Rough Arterie; for if you stop your nostrils and draw your breath through your mouth you shall not smell at all or freely any sense of an odour, neyther about the Pallat, or the Chops, or the Rough Artery. Wherefore the nose is the way, or the pathe or walke of odoriferous things, although to say truth it was ordained rather for Respiration, saith *Galen*, then to smell with.

The body therefore that perceiueh or apprehendeth odours is placed higher, and that is eyther the Spongy bone or the Mammillarie processes. Not the Spongy bone because, as is saide, bones are insensible together. It remaineth therefore that it must bee those processes which because they are somewhat like the nipples of a Dugge are called *Mammillares*, which proceeding out of the Basis of the Braine are by the *Pia mater* (saith *Archangelus*) ioyned to the braine and reposed in the vpper part of the Spongy bone called also *Ethmoides* (for wee will confound them) and because they are two, they are distinguished or separated by a production of the same bone carrying the Figure of a Spurrowell.

They are much of the nature of Nerves, as is before shewed in the 16. Chapter of the seauenth Booke, and therefore are best able (saith *Laurentius*) to discern of the qualities they receyue: yea (saith *Archangelus*) they seeme to haue their originall from Nerves of Smelling which do degenerate into them. For from the backe part of the marrow of the Braine at the fourth Ventricle doth the Odoratorie Nerve arise vnder the Optickes, and pacing forward are thrust into the Mammillarie processes betwixt the Braine and the Wedge bone. And these Nerves of Smelling (saith hee) were made as canales or pipes through which the Facultie of Smelling (residing in the Animall spirit drawne out of the fourth Ventricle) might be transported vnto the Mammillarie processe or the organes of Smelling; as the Faculty of Seeing through the Opticke nerves is transported vnto the eyes. The originall of these Nerves was vnkowne to *Vesalius*, *Columbus* and the rest, because haply they vsed to Dissect onely putrid or stale heades. But we returne vnto *Bauhine*.

These Mammillary processes (hauing a peculiar Nature, Figure and Composition of their owne) are esteemed to be the principall organs of smelling, especially because there is no part in the nose which can so easily be altered by odours as these: for being full of spirits they do soone receyue the species of odours. For whereas odours do consist in a kinde of exhalation (which is manifest because odoriferous things doe onely so farre forth smell as they exhale; whence it is that in Summer the scents of things are more fresh and fragrant then in Winter) and exhalations are naturally dry, it was fit that the organe of Smelling should proceede from a moyst principle, that by reason of the contrariety betweene the Object and the Organe which is necessary in all actions, the instrument might suffer and be mooued by the exhalation. And because the exhalation when it was come vnto that place might better bee dilated or extended, this instrument dooth not arise from the Spinall Marrow, nor from out of any part compassed or constrained within narrow limits, but out of the very middest of the Braine where they are wrought out of the substance thereof, and thence produced forward determine in the top of the nose, and so become the Organes of Smelling.

A briefe colle-
ction of the
maner of smell-
ling.

Wee conclude therefore that the Smell is made after this manner. The Ayre altered with Odours or by an aiery exhalation of odoriferous things is received by the Nose, which like a Chymney is broad below and narrow above; but because the proper motion of the exhalation is but weake that it cannot make a sufficient impression; it is increased by traction. Wherefore when the mouth is shut and the Chest dilated (for vnlesse the Chest be dilated we can smell nothing) the exhalation that is disperfed through the ayre is by inspiration drawne into the nofethrils: and because out of them there are two holes which go vnto the pallar, the greatest part of that ayre so drawn in entred into the lungs but without any sense of odours; the rest ascendeth vpward to the instruments of Smelling, but it is altered in the spongy bones euen as in the cauities of the eares the auditory ayre is prepared. This ayre thus altered in the Labyrinths of the spongy bones together with the species or forme of the odor passeth thorough the holes of that *Sine* into the *Mammillary processes*, or by them it is received and so conueyed to the common Sense which is in the Braine that it may iudge thereof. For the Braine is the common instrument of Sensation or the organe of all the senses, or it is the instrument by which the *Sensatiue Soule* perceiueth all sensible qualities, yea distinguisheth and iudgeth of them. And thus much of the vpper part of the Face, wherein three Senses are situated, of which we haue intreated.

CHAP. XXIX.

Of the Parts of the Face which are betwixt the Nose, the Eares and the Chinne.

The particular
parts, with
their names.



He parts of the Face which are onely in men and vnder the eyes betweene the nose and the eares reach as farre as the chin, the Ancients called in Greeke *μῆλας*, in Latine *Gena*, because in them haire is generated. We call them the cheeks. They are diuided into an vpper part and a lower. The vpper is next vnder the Eyes, a little rising betweene the nose and the Eares and for the most part is red, in which place *Plinie* supposeth that modesty or shamefastnesse hath her seate, because that part blusseth in those that are modest. *Hippocrates* called *ἡ κυκλὸς προσώπου*, the circle of the Face, & *Πόλλυξ* *μῆλον* the Apple of the Face, because in forme and colour it is not vnlike an apple, besides their color flourisheth most in the Summer of our age.

The lower part is looser, and is all that which is without the closing of the two Iawes, reaching almost all along betweene the chin and the eyes: when your mouth is open you may raise it vp with your finger on the inside, or make it shut when you fill your mouth with Ayre, not suffering it to go into your Lungs or out of your mouth. This is called in Greeke *γυῖος*, in Latin *Bucca* the Puffe of the Cheeke; That part which is betwixt the nofethrils and the vpper lip is called *Μυσταξ*. The cavity which parteth the vpper lippe in two which is an impression therein like a valley, is called in Greeke *φίλτρον*, as it were *amiable or louchly*.

Archangelus

The Lips are cald *Labra* by *Cicero*, by others *Labia* a lambendo of licking, for saith *Archangelus*, men licke with their lips, though other creatures, as Dogs and Cats and Oxen licke with their tongues. They are two, one vpper another lower, and are nothing else but Musculous extremities of the mouth. *Aristotle* in the 11. Chap. of his first Booke *de Historia Animal.* calleth them *χείλα* because they occupy the very mouth. *Homer* also calleth them *χείλα*, and *Lycophron* in that prouerbe vsed I thinke in all Languages:

A prouerbe out
of *Lycophron*.

πολλὰ χείλες καὶ δευτέρῳ πόλιν
μέσω κυλίσσει μοῖρα παμμήτωρ σφολόν,

Great Destinie twixt the Lippe and the lippe,
Caufeth strange chances often to slippe.

The vtmost and prominent parts of the lippes are called *προχίμα* *prolabra* by *Ruffus*, and those parts that meete and looke redder then the rest because of the affluence of blood are called *πρόσθια* by *Pollux* and *Ruffus*. The hole which the two lips make when they are diuided is called *στόμα*, Or the mouth. Finally, the lower part of the Face vnder the neather lip which groweth sharpe is called *γένιον* by *Xenophon*, by *Cicero mentum à memorando* because it should seeme there is some vse of it when wee desire to remember any thing. No creature (sayeth *Plinie*) hath a Chin but man, which if it be round (according to *Pythagoras*) is a signe of an effeminate minde. The doke or dimple in the middest of the chin and

and a great ornament too, is called *ρύμφη* the Nymph; the very sharp poynt of the chinne, bearing out in the lower Iaw is called *ἔξυγος*; the flesh vnder the Chinne is called *λευχασία* in Latine *Buccula*, we call it a double Chinne. To conclude, the hayres that breake out in the Cheeks, the Lips and the Chinne make the Beard, of all which parts wee might discourse at large out of our Authors, but that we haste to that which is more profitable.

CHAP. XXX.

Of the Mouth, Palate and Vvula.

THat which is in Greeke called *στόμα*, in Latin *Os*, we call the *Mouth*, comprehending vnder that appellation not only the Cleft which is made by opening of the Lips, but also al that voyde cavity which is betwixt the lips and the roots of the chops, which are called *Fances*. It is situated in the fore and middle part of the Face, that the hands might equally reach the meate on either side vnto it.

The mouth.

It is also immediately vnder the Nostrils, that not onely the Savors or Tastes of our meates might bee offered to the Mouth, but the Sauours & Smels or Odours to the Nose-thrils. For it is fit both the Sences should iudge of that we put into our bellies.

The reason of the situation.

The parts of the mouth are of two sorts: some are those whereof the Mouth is made, others such as are containd within the Mouth. The parts whereof the Mouth is made are of two sorts, some fleshy, others bony. The fleshy parts are the Lips; the Muscles of the Pusse of the Cheeks, of the Lips and of the lower Iaw. For on the foreside the Mouth is compassed with the Lips, as well to shut vp the Mouth when we would, as also the better to sap liquid things; on each side are the Pusses of the Cheeke swelling out. These parts are couered with the Skinne hauing Fatte vnder it, which Skinne in the middest is flitte ouerthwart like the Eye-lids to giue way for the receiuing of Aliment.

The parts of the mouth

The fleshy.

The Bones are the vpper and the neather Iawes, with the Teeth fixed into them both. All these parts as also the whole inward capacity of the Mouth is compassed with a thick membrane which in the palate is somewhat rugous, spreadeth ouer the Gummes, couereth the vpper part of the Lips, and being reduplicated maketh the *Vvula*.

The bones.

The palate.

The chiefe vse of the mouth is double; first to giue way for the assumption of meates and drinckes, and that in the mouth they might be Tasted. For the Taste is apprehensue of that quality of the meate which is fit for our nourishment, wherefore in the very ingresse of the mouth is the Tounge placed which is the proper instrument of the Taste, that nothing may be admitted into the mouth which doth not make his quality manifest by the contaction of the Tounge: againe to breake the Aliment and to shred and mingle it before it be swallowed, that it may go prepared into the stomacke.

The chiefe vses of the mouth.

The second principall vse of the mouth is for Respiration, that when the Nose is stopped the aire may yet be transported, some of it vpward to the top of the nostrils, some of it downward to the Longues, for the nourishment and expurgation of the vitall spirits: especially for the framing of the voice, for we speake out of our mouths.

The secundary or lesse principall vse of the mouth is, that thorough it by hauking wee might auoide the excrements of the head, by Coughing the excrements of the Chest and the Longues, & sometimes also by Vomiting those of the Stomacke.

The secondary vses of the mouth.

The Muscles common to the Pusse of the Cheekes and the Lippes are foure, two on each side. The one called *Quadratus* or the square muscle, the other *Buccinator* or the Trumpeter; and these muscles beside the vses they haue in beasts do in men helpe the Speech, especially the Sounding of a Trumpet or winding of a Horne or Cornet.

The common muscles.

The lips which couer the mouth are two; one aboue, another below, whose substance saith *Galen* in his 4. Booke de *Anatom. Administrat.* and the third Chapter, is fleshy, fungous and moouable, and that after an vncouth mannner: for the Skin and the Muscles are throughout exactly mingled together, so that *Galen* in the 11. Booke de *usu partium* and the 15. Chapter, calleth the conformation of their substance a *Musculous Skinne*, or a skinny Muscle.

The lips.

And as without they are couered with the Skin, so on the inside they are inuested with a membrane common to the stomacke and the mouth: whence it is that in those that are about to vomit the lower lip is often seene to tremble. These Lippes all creatures haue to eat and drinke with; but men make farther vse of them to helpe their speech, to auoide their

their

Table 13. Figure 1. Sheweth the muscles of the Fore-head, the Eye-lids, and the Cheeks.
Figure 2. sheweth the muscles of the Nose, Lips, the lower law and of the bone Hyois.

TABVLA XIII.

FIG. I.



FIG. II.



μ 2, the insertion of this muscle into the lower jaw. ν 2, A small nerue running to the forehead out of the orbe of the eyes.
 π 2, A nerue propagated to the face. ρ 2, two beginnings of the seventh muscle of the head. τ 2, His insertion into the Mammillary proesse. υ 2, the clauicle or the collar-bone. ϕ 2, A place where the vessels attayning to the head and the nerues of the arme do passe through.

A 1, 2, The muscle of the fore-head and the right fibres thereof.

B 1, 2, The temporall muscle.

$\alpha\beta\gamma$ 2, His semicircular originall.

CE 1, The first muscle of the Eye-lid compassing the whole lid.

FD, 1. The third muscle of the wing of the nose which endeth into the vpper lip.

GH 1, The muscle of the vpper lip.

G 2, The place of the yoke bone without flesh.

I 1, the broad Mouse-muscle stretched ouer the cheeks and all the lower parts.

δ 1, 2, the circumscription or circumference of this muscle.

I 1, the yoke-bone.

I 2, the grinding muscle or the second muscle of the Jaw.

The forward K, in the second figure sheweth the higher gristle of the nose.

L 2, the wing of the nose.

M 2, A muscle forming the cheeks.

N 2, the muscle of the lower lip.

O 2, A part of the fift muscle of the lower iaw called *Diagastri-*
cus, that is, double bellied:

P 2, the bone *hyois* is set in this place.

QR 2, the first muscle of the bone *hyois* growing to the Rough artery.

S 2, the second muscle of the bone *hyois* vnder the chin.

The lower T, in the second figure sheweth the third muscle of the bone *hyois* stretched to the iaw: the vpper T, in the second figure sheweth the insertion of the head.

VV 2, two venters of the fourth muscle of the bone *Hyois*.

the backward K, (put in stead of X) sheweth the seventh muscle of the head and his insertion at the vpper T.

λ 1 2, the originall of the grinding muscle from the yoke-bone.

their spittle, and moreover they defend the Teeth from the coldnesse of the ayre, and are a great beauty to the Face.

The proper
muscles of the
Lips.

For the performance of all these offices they stood in need of Muscles, some of which are common with them and the Puffe of the Cheeke, of which we haue made mention before: others are proper to the Lips onely, and they are fixe; two on eyther side belonging to the vpper Lip, and one on eyther side belonging to the neather.

The lawes:

The lawes are two. The vpper which in men is mouable, and the lower which is moued voluntarily with a double kinde of motion; one simple another compound: the simple motions are fixe, vpperward, downward, to the right hand and to the left, forward and backward.

The compound motion is made of that which is to the right hand and to the left, and that which is forward and backward: and by this motion the law is *circumduced* or led about. It is moued vpperward by the muscle called *Temporalis*: downward by *Diagastri-*
cus, to the right hand and the left by *Masseterius primus*: backward by *Masseterius alter*: forward by the fift paire: of all which as also of the common Muscles we shall intreate in the book of Muscles and of the Bones.

The parts contained in the mouth are diuers besides the teeth and the bone *Hyois*, of which we shall intreate among the bones. These are the Gums, the Palat, the *Vuula*, the Almonds, the Tongue, the Larynx or throtle, the Muscles of these parts, and the beginning

ning of the Gullet.

The Gummes are made of flesh, which *Auerhoes* saith is glandulous; the *Gracians* call it *ἰσχυρὸν τριβύλιον* which signifieth to inuolue: it is hard, saith *Baubine*, and immouable that so the teeth might be better fastened in their sockets, so hard the gums are that such as haue lost their teeth are able to breake their meate sometimes with them.

The Palate is the vpper part of the mouth, wherefore the ancients, as *Hippocrates*, and *Galen* from him call it *ὑπερώα*; *Aristotle* *ὑπαράς*, as it were *Cælum oris*. The Latines call it *Palatum*, because it is fenced in with teeth, as it were with Pales, as if one should say *Paled in* [tab. 13. fig. 4.*] The extension of the Palate is from the backpart of the mouth to the teeth and is hollow like an Arch, but the rooffe is not too high, hence wee call it commonly the rooffe of the mouth, but those whose heads are acuminated or like a Sugar loafe, haue high roofes or palates, as *Hippocrates* obserued in the first section of the sixth Booke *Epidemion*. This is the soale or basis of the Braine established by the wedge bone, which therefore *Galen* calleth the bone of the palate, though, saith he in his 19. Chapter of his 11. Booke *de usu partium*, it scarce touch the palate.

It is made partly of bony substance and partly of fleshy; the bone is hard and fast, lest it should rot by the confluence of excrements vnto it, as wee see it doth in the French disease. This bone is double on both sides, for it is compounded of the 4. bone of the vpper iaw into

which the teeth are fastened, and the sixth bone which maketh the backward amplitude therof. It is also diuided in the middest by a Suture, in the end whereof are two holes through which the braine is purged into the mouth, and so there becomes a great society betweene the nofethrilles and the palate. Through these holes when we hold our mouths close we may expire and inspire, breathe in and out, and when the wayes of the nostrils are obstructed, the excrements gathered together in the ventricles of the Braine are this way deriued into the mouth. But the backward halfe of the palate which endeth into the *Fauces* or chops, and is stretched out from one side to another, consisteth of a thicke and glandulous flesh.

It is inuested with a thicke coate arising out of the *dura mater*, which hauing gotten out of the skull is enlarged, becommeth thicker and compasseth the whole mouth and palate on the inside, yea it is common also with the gullet and the stomacke. Hence cometh the great consent betweene the Palate and stomacke, for it was fit that the coate of the palate should haue the sense of Tasting, that it might take the assay vnto the stomack. Wherefore the sense of it is more exquisite, as receiuing into his back part certaine small nerues of the fourth coniugation, which coniugation is also distributed vnto the palate.

This is also the cause why wee cannot euacuate the head with Masticatorie Medicines, but the stomacke also will bee euacuated by the palate: now the head is euacuated by the palate, because from the head certaine hayry threds of veines doe descend vnto the palate.

This coate of the palate in some places is rugous and rugged, which *Plinie* calleth *Crenas*, that the meate might be better mitted. It is also hollow or concauous, that the voyce might be better formed when the ayre is reuerberated; in this concauity also as in a bosome the ayre we draw in is warmed, that it should not descend cold vnto the vitall parts to offend them.

The Vuula hath many names: It is cald *Gargareon*, or *Curgulio* by *Hippoc.* by *Aristotle* *κίον*, but the proper name is *Gargareon*; *κίον* and *σαβύλη*, that is *vuula*, are the names of it when it is ill affected. The name *Gargareon* is a made word of the sound we make when we gargle, or else from Gargles which we vse in the diseases of this part. It is called also *Columella* & *pletrum*. It is a particle of the mouth or a certaine proceffe saith *Ruffus*, hanging directly downeward (from the inward part of the palate [table 13. figure 4. E] neare the holes of the nostrils which looke into the backpart of the mouth) into the capacity of the mouth betweene the Almonds [F F] aboue the slit of the larynx or throtle [E] as will easily appeare if a man open his mouth wide and presse his tongue downeward.

The substance of it is glandulous, red, and fungous hanging downe from the middest of the glandulous part of the palate. Some thinke it is made of the coate of the palate reduplicated at the end of the mouth and a litle elongated, this was *Columbus* his conceit.

If it be diseased by a fall of humors it is no more called *Gargareon* but *κίον* and *κίον* and *σαβύλη* and *κίον* and *κίον* and *κίον*.

For if it grow equally thicke from the Basis to the end, and fall lowe, become redde,

H h h

then

The palate.

Whereof flamed.
The bones of it.

The holes of it

The coate of the palate.

Pliny.
Why it is hollow.

The names of the Vuula.

The substance.

The names as they are properly given.

then it is called *κίον*, that is, a Pillar; but if the vpper part be slender, and the lower part grow round and liuid or blackish, then is it called *καρύς* or the *Vuula*, because it is like a Grape both in colour and in magnitude, the stalke being the vpper part. It is called also *αν-νίς*, and therefore *Galen* calleth them in whome it is ill affected *κίονος*.

The vse of the *Vuula*.

The vse of it is to temperate and moderate the coldnesse of the ayre we breath in, that it fall not suddenly vpon the Longues, and so the bloud (saith *Aphrodisius*) become condensed and thickned by the Inspiration of cold ayre, whereby the motion of the Longues might be made slower; whence it would follow that vpon so great a contention in the motion, the vessels might be broken and a consumption follow.

Another.

Another vse of it is to moderate and Tune the voyce, for only Men and a few Birds haue it: hereupon it is called *plectrum vocis* the quill of the Voyce. For hanging in the cavity of the Palate betwixt the *Larynx* and the cavity of the nostrils it maketh a repercussion of the ayre as it yssueth out of the Throttle. Hence also it is that it helpeth pronounciation very much as *Columbus* saith; who also auoucheth that if it be eaten away by the French disease, or cut off when it is inflamed, the voyce will neuer be shrill or cleere after.

Columbus.

Gainfaide by *Falopius*.

This *Falopius* gain-faith vpon his owne manifold experience, and *Bambine* telleth a Story of a Marchant whose *Vuula* (for I know no other name for it in English) had been some yeares since consumed by a defluxion of sharpe humors, who yet found no decay or fault in his speach to follow vpon it, marry otherwise he grew *Tabid*, that is, into a consumption. Wherfore, saith he, we conceiue that those that haue their voyces impayred by the French disease, doe not only loose their *Vuulas*, but the Vicers eat away a great part of that glandulous body which is betwixt the Bone and the coate of the Palate, or else the bone of the Palate and the membrane is perforated. The like conceit also hath *Falopius*.

A third vse.

Some adde a third vse of the *Vuula* to purge the Ayre, for it licketh vp the dust which otherwise together with the ayre would descend into the Longues. But *Vesalius* doeth not approue of this vse, and he rendereth this reason, because other creatures that drawe their breathes nearer the earth (and so more in danger of dust then men) haue not yet this *Vuula*.

Varolius his vse of the *Vuula*.

Finally (for I will not insist vpon euery mans conceit) *Varolius* concerning the vse of the *Vuula* expresth himselfe on such a manner.

The *Vuula* receiueh the excrement of the braine conuayed vnto the Phlegmaticke glandule through the Tunnell; this excrement it imparteth vnto the Palat, the Tongue and other instruments of the Voice to moysten them, that which is ouerplus is cast out by spitting and hauking. For as in a Flute the Sound will not be shrill and cleare vnlesse it bee wet, so it is in the voyce of a man: and therefore Nature placed the *Vuula* which receiueh the moysture of the braine directly ouer the slit of the Throttle or *Larynx*, that it together with the rough Artery might better be moystined.

CHAP. XXXI.

Of the end of the Month called Fauces or the Chops, and their Glandules.

The extent of the word.



ALTHOUGH the word *Fauces* or the Chops, doe among some Anatomists, *Vesalius* and *Laurentius* especially, signifie all the capacity of the mouth; yet properly it signifieth the backward and lower part of the mouth, or that space where the ends of the Gullet and Rough Artery doe meete, and may not bee perceiued vnlesse the mouth be wide opened and the Tongue depressed. [tab.

13. fig. 4. betwixt F and I] The Grecians call it *φάρυγξ*. Yet this word *φάρυγξ* hath diuers significations: sometimes it is taken for that wee call *Fauces* or the Chops, sometimes for the *Larynx* or Throttle, because they are neare together, sometimes also for the whole Rough Artery. *Aristotle* in diuers places giueth this name to the Gullet. *Philoxenus Erixius* saith a notable Gourmandizer wished *φάρυγξ* (that is his Gullet) longer and bigger then a Cranes. Some by this word vnderstand all the glandulous bodies about the Chops. But in *Hippocrates* where we haue this word *φάρυγξ* put by it selfe, it signifieth some disease of the Chops, as their roughnesse, in the fift Aphorisme of the third Section, or their Infla-

mation as in the seventh Section of the sixth Booke *Epidem.* and the first Aphorisme. This place also is called *ισθμος* by *Galen*, and *ισθμους* by *Hippocrates* by a Metaphor, because of the narrowness of the place: for *Isthmus* signifieth properly a narrow tract of ground betwixt two Seas, and in the whole body there is no part so narrow and straight which containeth so many instruments. For in those *Fauces* are contained, first, the holes of the nostrils descending through the palate into the mouth [*Table 13. Figure 4. after E*] of which we have spoken in the Historie of the Nose; againe, the muscles of the *Fauces* or Chops, the bone *Hyoides* vnder the root of the tongue, the tongue it selfe, the *Larinx* together with the *Epiglottis* and the beginning of the gullet; beside the muscles of these parts and some of the lower iaw. Add hereto certaine propagations of the nerves of the third, sixth and seventh coniugations, the iugular veines; the sleepey Arteries, and certaine glandules of which we will intreate in the next place because they are best exhibited in the thirteenth Table.

Why it is called
Isthmus.

What parts are
contained
therein.

There are three sorts of Glandules in the region of the Chops.

The first is vnder the roots of the Eares (which *Vesalius* accounteth for the third kind) of which we will speake in the 11. Booke. The second are those they call *Tonsilla* or the Almonds, of which we will intreate in this place. The third are those (*Vesalius* calleth them the first) which grow at the roote of the *Larinx* on the sides of the rough Artery, of which we shall make mention when we come to the *Larinx*, but discourse of in the 11. Booke.

Three sorts of
glandules neere
this place.

The Almonds are commonly called *Tonsilla* [*tab. 13. fig. 4. F*] *Celsus* calleth them simply Glandules. They are situated in both sides of the Mouth at the rootes of the tongue betwixt the holes of the nostrils and the *Larinx*, or betweene the beginnings of the weazon and the gullet, on either side one, large, long, and compared to Almonds, and therefore they are commonly called the *Almonds of the throte*. The *Gracians* call them *αμυγδαλα*, because they are seated in the *Isthmus* of which we spake even now. For if you looke into the cavitie of the mouth when the lower iaw is remooued, you shall see the two holes of the nostrils and the *Vula* or *Gargareon*: the two holes like two seas, and the *Gargareon* like a narrow tract or necke of land running betweene them. By the same name of *Paristhmia* they vse also to call not onely a part of the *Fauces* or Chops, but also the inflammation thereof, yea the disease of these glandules when they are inflamed, or when they swell or are resicuated, when they hinder (saith *Paulus*) the free passage of the drinke or the breath. For their swellings seldome hinder the passage of the meate because being but lax loose bodies the weight of the meate beareth them downe before it, and by this wee commonly distinguish betweene the inflammation of the Muscles of the Tongue, which we call an *Angina* or Squinsie, and the swelling of the Almonds; for in the Squinsie wee cannot swallow any thing without great difficulty, and the more solid thing the worse; in the swelling of the Almonds we can hardly draw our breath or take downe any liquor, but solid meate will goe downe much more easily.

The almonds.

The difference
betweene the
swelling of the
almonds and
the squinsie.

Sometimes also by the word *Paristhmia* is vnderstood the inflammation onely of the coate which we saide was common to the Chops, the whole mouth and the stomacke; sometimes the inflammation of those muscles which ly next vnder the saide coate, sometimes the inflammation of the bodies which are within the *Fauces*.

Paristhmia.

They be also called *αμυγδαλα* by *Hippocrates* in his second Booke *de morbis*, because they are placed in opposition one vnto another; but this name is not giuen onely to the Glandules but also to their disease, so saith *Hippocrates* in the place before quoted; It will not bee amisse to thrust your finger into your mouth and to beare downe the *Antiades* that is, the Almonds when they are swelled. Yet some put a difference betweene *Antiades* and *Paristhmia*, for they say, that the Almonds themselues inflamed are called *Antiades*, and the inflammation of the parts about the Almonds *Paristhmia*. So saith *Celsus*, the *Gracians* call the Almonds which are hard after their inflammation *αμυγδαλα*.

Antiades.

They are couered with the common coate of the mouth and the other parts of which wee spake lately which is nervous and in many places perforated with large and ample holes, insomuch that some haue sayde it is fungous. These holes saith *Falopius*, if the glandules be a little swelled, are wont to deceiue Chyrurgions, for they take them to be Vicers, whereas indeed there are no Vicers at all; for when the glandules fall they become againe according to their wonted nature. They also receiue veines from the iugulars. Their substance is like that of the glandules, but more rare, spongy and fungous, and therefore *Hippocrates* in his fourth Booke *Epidemion* calls them *σπγγες* Sponges, because after the

How couered.

Another note
for Chyrurgi-
ons.

manner of Sponges they drinke vp humiditie, yet *Hippocrates* also calleth their tumors by the name of *σπύγαι*.

The vse of the almonds.

The vse of these Almonds is saith *Hippocrates* in his Booke *de Glandulis*, to receiue the moysture of the braine : this moysture it conuerteth into spittle, whereby all the parts within the mouth are moystened euen the Gullet-and the weazon, the Tongue also kept from drying, and made more glib and nimble. It helpeth also the Sense of Tasting, for we cannot Taste without moysture; like as in the stomacke there is no concoction or mitigation without boyling, whereof they haue experience whose Tongues are rough and dry.

CHAP. XXXII.

Of the Tongue and his Muscles.

The names.



The Tongue is called in Greeke, *λίσσα* in Latine *Lingua*, of licking, or because it is as it were tyed within the pale of the Teeth saith *Varro*. It is a notable instrument both of the Taste and of the Voyce; because in the Mouth it is placed next vnder the Palate [*tab. 13. fig. 4.1*] in the way, saith *Cicero* 2. *de Natura Deorum*, which Nature prepared for the passage of meates and drinks. The Basis of it resteth vpon the bone *Hyais* about which it is moued, and neare the *Epiglottis* it maketh an angle or corner, and from hence hangeth and walketh freely in the mouth.

The place.

It was fit (saith *Galen* in the fifth Chapter of his 8. Booke *de usu partium*) that it should be placed neare the braine as are the rest of the instruments of the Sense, because it is the principall instrument of the Taste. Wherefore Nature for the Tongues sake placed the Mouth in the Head that it might haue a den or caue or chamber to moue in, that it might bee a convenient instrument both of the Taste and of the Voyce, as also might helpe the chewing and swallowing of the meate.

The figure.

The figure of the Tongue is not alike in all Creatures, in some it is *Trifanged* as in Serpents, in others *Bi-fanged* as in Lizards; some haue two Tongues as the Sea-Calf. In Fishes it is fastned all along, in Lions and Leopards it is rough and furrowed, but in man it is somewhat long, thicke at the roote for strength, and broad that it might bee fit both for Taste and Speech. In the end it becommeth by degrees sharpe for quicker motion saith *Galen* in the 10. Chap. of the 11. Booke *de usu part.* *Archangelus* compareth it to a *Pyramis*.

The vpper and rough part called *ινγλωττις* is hollowed on either side, those they call *χρηματις* and *παρὰδρυα*.

It is soft, broad and loose or at liberty that it maybe conuayed, produced, dilated and diuersly disposed; for in those that are tongue-tyed we see a manifest defect of vtterance. We may also obserue out of *Aristotle* in the 17. Chapter of his second Booke *de part. Animalium*, that those Birds which can be taught to prattle haue broad Tongues about other birds: and the reason why brute beasts cannot deuide or articulate their voyce is because their Tongues are hard, thicke and not at liberty.

The magnitude.

The magnitude of the Tongue is not all one in all creatures, but proportionable for the kinde whereof they are. Neyther is the quantity of it all one in all men; but it is longer then broad, and broader then thicke, and also proportionable for the amplitude of the Mouth, saith *Galen* in the 10. Chapter of his 11. Booke *de usu partium*, that it might reach into euery corner and the nooke thereof, and not hinder the receiuing of meate. But it is faulty sometimes in magnitude, sometimes in the very substance together with his muscles. For if it be bigge it filleth vp the spaces of the mouth and the Chops, and then it cannot moue so deliuerly or nimbly as otherwise it would, and such men are called *blasi* and *balbutientes*, that is Lispers and Stutters, especially if (as it happeneth most what) it be also too soft or moyst. Hence it is that Infants and those children that are moyster then ordinary doe speake slower and later then others, because of the softnesse and loosenes of their Tongues and the muscles thereof, till when their heate by their age encreasing the ouer abundant moysture is consumed. The Tongue also sometimes is too short when the *Bridle* thereof is not enough cut, so then it is hindered that it cannot apply it selfe on euery side to the Mouth; or because the muscles being little it is moued too swiftly and so implicateth reciprocateh or doubleth the speech and maketh the words come hudling together.

Blas Balbi.

What children speak slowly.

If

It is tyed to the *Larynx*, to the bone *Hyois* (vpon which the rootes thereof resteth as vpon a Basis and by which it is supported) to the Chops also, and on both sides to the Almonds; below it is fastned with a ligament.

The connecti-
ons of the
tongue.

The Tongue is compounded of a proper flesh, a coate, nerues, veins, arteries, muscles and a ligament.

Whereof come
pounded.

The ligament is [tab. 14. fig. 3. 11] very strong, membranous and broad, and is vnder the middest of the body thereof.

The ligament.

The vse of this ligament is manifold: for the solidity and strength thereof listeth vp the Tongue, and not onely so but auaieth much to lill it forth. For were it not for this ligament the Tongue would bee too much gathered backward, neither when it is shot out of the mouth could it bee easily retracted or drawne in againe. Moreover, if it were on euery side free and loose, it had not bene so firmly established and fastened in his proper seate. This Ligament also receyeth the insertion, saith *Vesalius*, of the proper Muscles of the Tongue which otherwise would easile haue bene relaxed or loosened or else parted asunder. At the end of this Ligament toward the tip of the Tongue there groweth a little Chord which *Arantius* and *Laurentius* call the *Bridle* of the Tongue. For a mans Tongue in new borne infants is fastened euen vnto the end with a Tye which the Midwives do vse to teare with their Nalles, sometimes it is faine to be cut, because it is a hinderance to their speech, yea to their sucking, because it cannot lappe it selfe so well about the nipple. The tongue therefore beeing naturally nimble and voluble least it should bee alwayes importunately prating, is restrained by this Tye, as it were by a *Bridle*. Wherefore, by the helpe of the Ligament and the *Bridle* and of many Muscles working together and contracted towards their originall, the Tongue becommeth narrow and pointed, lifted vp and diuersly mooued, and withall restrained from moouing too farre on any hand.

It is invested with a coate common to it with the Mouth, the Pallate, the Gullet and the *Larynx* [tab. 14. fig. 1. A A, B B, C] least the lax and rare substance thereof should part asunder. This Coate is all very fine and thinne, that the sapor might more easly pierce through into the pulpe and substance of the tongue, into which coate as also into the flesh certaine Nerues of exquisite sense are disseminated.

The coate of
the tongue.

The substance of it is soft, loose, rare and like a Sponge that it might be the sooner moistened with the humour which carrieth the sapor in it, and so fitter to discerne of the diuersity of Tastes, for of them it is the competent iudge. Hence it is, that in diseases it is diuersly affected, for as the humor is that it imbibeth, so is the sense of the Tasting depraued, as we may see in those that are sick of the yellow Iaundise or of Agues. The flesh therefore of the Tongue is proper and peculiar to the tongue, there being none such in the whole body: toward the Basis it commeth neerer to a Glandulous substance then to a Musculous, because it is much softer and looser; yet hath it all manner of fibres, but those so intertexed and wouen together that they cannot be separated one from another which may be done in Muscles.

The substance
of the tongue.

Again, the Fibres runne through the length of the Muscles, which is not so in the Tongue; for it hath no Ligamentall Fibres to strengthen it as Muscles haue vnlesse it be a middle one which runneth vnder the tongue. Finally, no Nerues from the Braine that should giue it the power of motion do runne through the substance thereof, wherefore it cannot be called Musculous, although I know some men are of opinion that it is made of two Muscles arising out of the bone *Hyois*, and determining in the tip of the tongue seuered by a white line: some say also there are two other Muscles of which the pulp of the tongue is compounded: but if it werere made of Muscles it should onely mooue not taste, for what Muscle doth taste? We resolue therefore that the flesh of it is not Musculous.

That it is not
musculous.

At the roots of the tongue, besides the Muscles inserted thereinto, there adhereth a great quantity of hard fat.

The Fat of the
roots.

The tongue receiveth two kinds of Nerues, one soft which carrieth sense vnto it from the third and fourth coniugations, yet so that one branch is disseminated into the coate that investeth the tongue to be an instrument of *Touching*, for the Tongue is apprehensue of all the *Tactile* qualities, as cold, heate and such like. The other Nerue is sprinkled into the flesh of the tongue which is the instrument or organ of *Taste*, and by that meanes the tongue is made apprehensue of *Sapors*.

The nerues of
two kinds.

Table 14. Figure 1. and 2. sheweth the tongue cut from the bodie, and the Muscles thereof. In the first the right side of it, and in the second his Muscles some-what uncovered. Figure 3. sheweth the body of the Tongue diuided according to the length of it and his Ligament.

TABVLA XIII.

FIG. I.

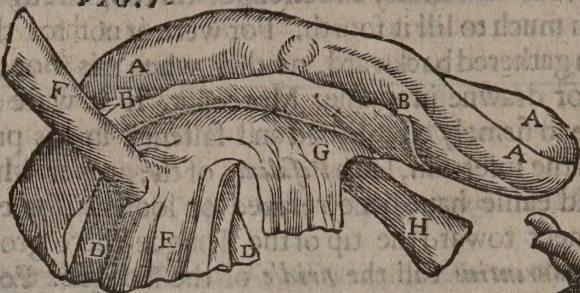


FIG. II.



FIG. III.



AAA, The tongue inue-
sted with a Coate com-
mon to the mouth.

BB, A portion of the coate
compassing the mouth cut
from the mouth according
to the sides of the lower
iaw.

C, A part of the same coate
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D, The Muscles cald *Basi-
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F, The Muscles called *Styloglossi* or the third Muscie. G, The Muscles called *Myloglossi*, or the fourth Muscle according to *Vesalius*. H, The flesh consisting of the Glandules, or the ninth Muscle of the tongue according to *Vesalius*. II, The Ligament of the tongue. KK, LL, The Musculous substance of the tongue, and the fibres thereof.

Caution.

The other kinde of Nerves is hard, that is, Nerves of motion, to wit, the seauenth coni-
ugation, which with many surcles is disseminated into his muscles that the tongue might
be mooued with voluntary motion; and because this Nerue is placed in the lower part of
the tongue, the Chyrurgion or Midwife must be very carefull lest when they cut the *Bridle*
they do not cut the Nerue.

The veines.

It hath also two notable Veines called *Ranina*, not because they are like Frogges, but be-
cause they are of the colour of a Frogge. They yssue out of the inward branch of the exter-
nall Iugular Veines and runne vnder the tongue, as it will appeare vnto any man that listeth
it vp. These Veines in the diseases of the mouth, the heate of the *Fauces*, the Squinzie and
such like, are opened for deriuation; after the blood is euacuated and reuelled by the ope-
ning of the *Humetarie Veine* of the *Arme*.

The arteries

It hath also two large Arteries on either side one from the sleepey Arteries which ac-
company the Veines. These are allowed to the tongue to maintaine the life of it, as the
Veines were to supple it with nourishment.

The body of it

The body of the tongue although it be continuall not diuided by any partition, whereby
it becometh fitter to Taste with, to breake the meate, and to articulate the voyce; yet it
is diuided or rather scored thorough the middest with a white line, which *Hippocrates* in
Coacis first called *Apur*, that is, the *Median*, which Line runneth thorough the very middest
of the surface of the tongue diuiding it into a right side and a left, yet not as it is in Lizards
whose tongues are forked; so that the tongue (as all other the Instruments of the *Senses*)
is double, and therefore *Galen* calleth it a *Double Member*.

The

The Uses of the Tongue. Although it bee but a little Member yet it is of great vse, because it expresseth all the conceites of the minde, wherefore our wise Creator hath defended it with many Teeth, with Lips, and restrained it with a Bridle, that beeing so carefully attended it might not run before the minde, which first ought to consulte and deliberate before the Tongue pronounce any thing.

The uses of the tongue.

The vse therefore of the Tongue is eyther primary or secondary. The primarie vse is, that it might be a conuenient and fit organ or instrument both of the Sense of Tasting and of the Speech. Of the Taste (which vse of the Tongue is common to Man and beast) to distinguish betweene all the varieties of Savors; wherefore *Aristotle* in the 11. Chapter of his first Booke *de Historia Animalium* saith, there is in the mouth γλωττα κομὴ ἀισθητικόν, A Tongue which is the Sensor of tastes. The taste which the Tongue hath it receiveth especially from the Coate which inuesteth the mouth, and particularly from that part of it which couereth the tongue. For whilst wee chew our meate the Tongue rowleth it selfe on euery side of the mouth and applyeth it selfe to the Viands to take a say or Taste of them.

The primary vse. For tasting.

Moreover, because we can thrust or lill out our Tongues, wee are able to discern of the Savors of those things also which are without the mouth if the Tongue do but touch them, especially with the very tip, for there saith *Aristotle* the taste is most quicke, in the 27. Chapter of his second Booke *De partibus Animalium*, and therefore saith he, in Fishes onely the very tippe of the tongue is loose, the rest is fastned downe vnto the Soale of the mouth.

The Tip of the Tongue.

Concerning the vse of the Tongue in the voyce, *Hippocrates* hath made mention in his Booke *De Carnibus*. As also *Aristotle* in the eight Chapter of his second Booke *de Anima*, for it is the very organ of Articulation, so we saide before that those Birds which haue broad tongues may easiely be taught to prattle, as we see in Parrats. *Euripides* therefore calleth the Tongue ἀγγελος λόγων, The Messenger of the Speech. And therefore a mans Tongue which is best proportioned and most at libertie, attaineth to the greatest perfection in the deliuey and variety of the voyce. For although a Parrat, a Stare, and such like Birds can moderate their tongues to a kinde of faigned distinction of Sounds, yet in man the sound is more expresse and better articulated. Beside, saith *Hippocrates* in his Booke of the *Epilepsie*, the Tongue of a man is the messenger of the Braine, that is, as *Bauhine* well enterpreteth it, of the Understanding and the Will; but in other Creatures it deliuereth onely the affections of the Senatiue soule which *Galen* calles *Rationem delitescentem*, A silent shadow of reason, which he attributeth to all Creatures denoyde of reason. So we see euen in the tongue of a man, sometimes it expresseth onely those things that fall vnder the Sense, as when wee cry for paine, or for Foode and succour; sometimes those things that fall vnder our vnderstanding as in Discourse.

For speech.

A mans tongue the messenger of the braine.

The Secondary Vse of the Tongue is for mastication or chewing, or breaking of the meate, and for diglutition or Swallowing.

The secondary vse Chewing.

By this motion of the Tongue those Creatures that want Teeth doe swallow their meate whole, as Birdes; and those that haue teeth doe with their tongues mooue their Viandes vnto their teeth whereby they are mitigated and broken, and so receyue in the mouth a good preparation for the Stomacke, which otherwise would not nor could not so easilie concoct them, for shreadde meate is more easily boyled then a whole loynt.

Againe, the Tongue helpeth the Diglutition by turning the meate ouer it towards the Gullet. By the Tongue also wee can licke and whistle, or varry the sounde of any Fife or Pipe, or such like. All these good offices the Tongue dooth in a man, in other Creatures but one or at least not all. For in the perfection of Creatures (sayeth *Galen* in the Fiffe Chapter of his second Booke *De Semine*.) Nature proceedeth by degrees from a Plant. The first Degree, is of those Creatures which haue onely the Sense of Touching; more perfect are those that Taste, yet more that Smell, then those that Heare: and finally, she addeth the Sense of Seeing which is the ytmost perfection of the sensatiue Soule.

Swallowing.

So steered T. tongue F. d. 1

Degrees of perfection in Creatures.

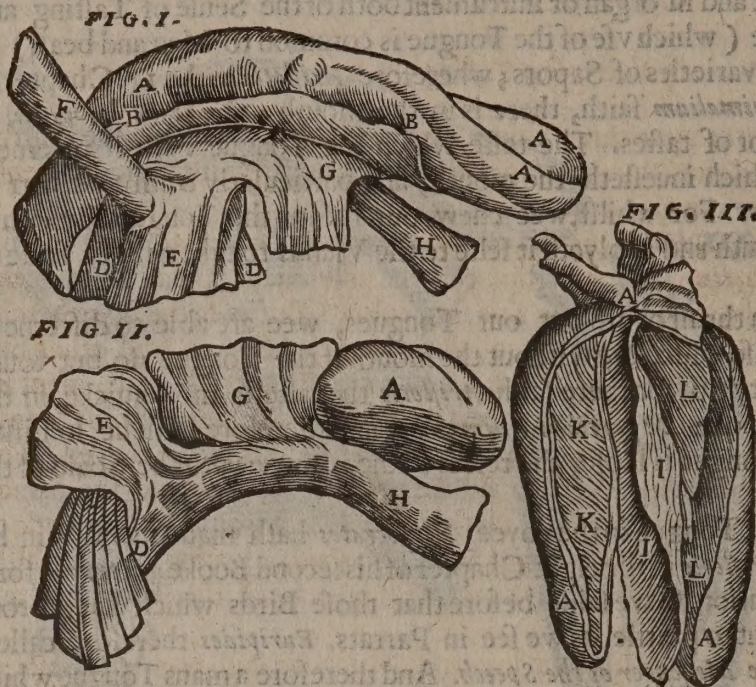
The Muscles of the Tongue are assistant vnto it in the performance of all his Functions of Speaking, Tasting and Rowling of the Meate: and therefore there are three kinde of Muscles belonging vnto it which we may call *Locutorij*, *Gustatorij* and *Gibi reuolutores*, the Speaking, the Tasting and the Rowling Muscles.

The muscles of the tongue.

The

Table 14. Figure 1. and 2. sheweth the tongue cut from the bodie, and the Muscles thereof. In the first the right side of it, and in the second his Muscles some-what uncoverd. Figure 3. sheweth the body of the Tongue divided according to the length of it and his Ligament.

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The chiefe vse of it in man is speech, the chiefe vse in Beasts is tasting, because they want hands to gather and apply their meate vnto their mouths as men haue: but both men and beasts when their meate is in their mouths doe rowle it with their tongue, or turne it ouer into their Gullets. The tongue must therefore bee moouable and haue Muscles, which Muscles are of two sorts, some Common, others Proper. These are accounted common Muscles which belong vnto the bone *Hyois*, and those proper which haue their originall from other where, and do determine into the substance of the tongue, and they are accounted five paire called *Styloglossi*, [tab. 14. fig. 1, 2. F] *Myloglossi*, [tab. 14. fig. 1, 2. G] *Genioglossi*, [tab. 14. fig. 1, 2. H] *Basiglossi* or *Tp siglossi*, [tab. 14. fig. 1, 2. D O] and *Ceratoglossi*. [tab. 14. fig. 1, 2. E] But of these we shall entreat particularly in the Booke of Muscles, heere it is enough to haue pointed them out.

Five paire.

The roote of
the Tongue.

These Muscles being remooued, at the roote of the tongue there appeareth a kinde of flesh made of many glandules and fat mixed together, which saith *Archangelus* doth not deserue the name of a Muscle, so saith also *Columbus*, yet hee reckons it for the 11. Muscle, because the Anatomists before him accounted it for a muscle. But a muscle is not made of glandules but of fleshy fibres.

The vse of the
kernels.

This heape of Glandules [Table 14. figure 1, 2. H] groweth to the roote of the Tongue that it might continually be moistned, for without moisture there can be no Gustation. So in the stomacke there can be no concoction without Elixation or boyling, wherefore Nature ioyned to the Stomacke the *Pancreas* or Sweete-bread a glandulous body, that from thence might continually steame moyst vapors, that so the concoction of the stomacke might be made by *Elixation* or boyling. Beside, the moysture which the Tongue receiueth from these glandules makes it more glib and easy to be moued; for if it be dryed it will not mooue

mooue so readily, as we may see in those that are very dry, and in hot burning Agues when the humour or moysture of the Tongue is exhausted. Beside the Glandules, the Almonds also of the throat (as we remembred before) do continually moysten the Tongue and help his motion. And thus much of the Tongue.

CHAP. XXXIII.

Of the Sense of Tasting

WEE said before that there were three things required in euery Sense; the Instrument, the *Medium* and the Obiect. Which three we will shew in this fourth sense of Tasting as far as we can gather out of Anatomy.

The Physitians (following *Galen* in his Booke *de Instrumento odoratus*, and the fifth Chapter of his 7. Booke *de Placitis*) doe determine that the instrument of the Taste is the Tongue, and that it is affected to Savors as the Eye is to colours. But as in the Eye there is one particle which is said to be the most principall instrument of Seeing, the other but assistant: so in the Tongue there is one similar part which is the principall instrument of Tasting, and that is the rare and laxe substance thereof, which is therefore rare and spongy, that it might be better steeped with the moysture wherein the Savors are conuayed. The other parts of the Tongue are but helpers and handmaids all contributing vnto the principall part. This substance, call it flesh, or pulpe, or what you will, because it was made to receiue all Savors was to be deuoyde of all Sapor, that is, *insipid* or hauing no Taste all as we vsually speake, and that it is so any man may perceiue if hee eate of the Tongue of any beast boyled fresh and without any sauce.

The instrument of tasting

The principall particle.

The matter wherein the formes of Savors do consist which we call *Natura subiecta*, is moyst: for without moysture (saith the Philosopher in the 20. Chap. of his second Booke *de Anima*) nothing can make an impression of a Sapor, and euery thing that maketh this kind of Sensation or moueth this Sense hath humidity in it, either *Actu* or *potentia*, that is, eyther Actually and Readly or in Possibility; and by how much a thing is the moyster, by so much is it the more sauoury, because all things when they are moyst doe make a better impression of their Sauour then when they are hard.

The matter in which tastes do consist.

Hence it is that those things that are hard as Pepper and such like; do not make shew of the gustile qualities vlesse their vpper and superficiall parts do giue as we say, or melt, or be moystned. The sweetnes of Sugar we Taste better when it is melted, and a corne of Salt will strike the sense much more after it is dissolued then before. An infusion of Rheubarbe is much bitterer then a peece of Rheubarbe held in a mans mouth. Seeing then that Savors are not perceiued but as they communicate their qualities to moyst substance; it followeth that the Instrument of this sense must neyther be actually moystned; yet of such a substance as cannot be moystned: but it must be Potentially Moyste and Actually moystned, yet so that when it is moystned the Nature of it must be preferued.

Hence it is that when the Tongue is eyther too dry or too moyst it doth not Taste well. For example, if a man Taste of any sharpe or vehement thing as Pepper, and then presently Taste of another thing, he is not able to iudge well of the latter; the reason is because the Tongue is already possessed and forestalled or taken vp with the former sharpe humour. So likewise we see that those that are sicke thinke all things bitter, the reason is because their Tongues are moystned with a bitter iuice.

Why sick folk thinke all things bitter.

The Tongue therefore was made of an earthy and dry substance; for albeit because of the softnesse it may seeme to be moyste, yet this moysture is not *Innate* but an acquired moysture distilling perpetually out of the braine which insinuateth it selfe into the Tongue as water doeth into a sponge. That this is so it is euident, for if the distillation out of the head be stayed, the Tongue is presently exiccared, yea so parched by hot vapours eleuated from the Liuer, the Stomacke and the Lungs, that it becommeth rough, yea in Agues it cleaueth or choppeth and the marks or scarres of those fissures remaine many yeares to be seene; which thing (saith *Bauhine*) I haue experience of in my selfe, for 17. yeares since I had an Ague, and my Tongue cleaued or chopped in the middest, and yet the marke of it is manifestly to be seene.

Bauhine of himselfe.

Galen therefore in his Booke *de Odoratus Organo*, and in the sixt Chapter of his seauenth Booke

Booke

Booke *de Placitis*, hath truly taught vs that the instrument of Tasting was made of a moyst substance, where he intendeth to diluier the qualities of the instruments which are most appropriate to the particular Senses. For if the Tongue bee too much exiccated, the *Perceiuaunce* or knowledge of Sapours must needs perish: and therefore Nature set the Almonds neare the Tongue least the ayre that is continually drawne and let out by Inspiration and Expiration should dry it too much. And so much of the Instrument.

The medium
of the taste.

The *Medium* of this Sense we take to be the coate of the Tongue, as the Cuticle or Scarf-skin is the *Medium* of the Touch. For (sayth the Philosopher in the 14. Text of the second Booke *de Anima*) all things that are apprehended by any Sensation we apprehend by a *Medium*, there being no Sensation made by immediate contraction of the Instrument and the Obiect; although afterward in the 10. Chapter of the same Booke (not so well aduised) he denyeth that either the Taste or the Touch haue any *Medium*, to which place we refer him that is desirous to know his reasons.

The obiect.

The Obiect of the Taste are all things that haue any Sapor or Gustable qualities in them. But the qualities of Gustable things are of two sortes, some properly belonging to the Sense of Tasting as Sapours (For as the obiect of the Sight is Colour, so the obiect of the Taste is Sapor; yet nothing that is without moysture exhibiteth any Sapor to the Sense) others are Common to all the Senses as the Magnitude of that which is Gustable, the Number, the Situation &c. Wherefore we say that the Tong doth Taste the Sapor of wine, not the wine; yet from this Sapor the Soule gathereth that it is wine which we Taste. For wine as it is wine, and sugar as it is sugar are not the Obiects of the Faculty of Gustation, but as they are indowed with Saptors or Gustable qualities. The Soule indeed by discourse of Reason distinguisheth betweene a sharp Taste and a bitter, but it is by the mediation of the Sense of Tasting; when the Sensible qualities of those sharp or bitter things do moue and affect the Faculties of Sensation. But that a Sapor may be exactly iudged of or apprehended, the body wherein that Sapor is, must be broken betweene the Palate and the Tong, and therefore the Palate and the Tongue are compassed about or inuested with one and the same coate.

Hence it is that euen the Palate helpeth the Taste, because also it receiue the like distribution of nerues of the same coniugation the tongue hath.

The kinds of
savors.

The kinds of Saptors as the Philosopher saith, are accounted after the same manner with the kinds of Colours. For as white and blacke are contraries, and the other Colours leane to this or that Contrary; so *Sweete* and *Bitter* are the two simple contraries; to sweete adheareth that we call *Fatty*: to *Bitter* that which is *Salt*: and betwixt these are Byting, as Pepper, Harsh as vnripe Sloes, Sowre and sharpe as Vineger. For these are the differences of Saptors according to the Philosopher; concerning which he that will know more let him resort to *Galen* his first Booke *de simplicis. Facultat.* where also he shall finde what was *Platoes* Philosophy concerning the difference of Saptors. I must not insist vpon all.

The conclu-
sion.

We conclude that the Tongue as the Instrument of the Taste being neyther drye nor too moyst, nor steeped or dewed with any ill iuyce, doeth through his coate as through the true *Medium* Receiue and Perceiue the Saptors that consist in a moyst body, and that by a Faculty or Power yssuing from the braine by the nerues of the third and fourth coniugation, and penetrating into the Instrument of Tasting, that is, the Flesh or Pulpe of the Tongue.

For the Faculty (sayeth *Plato* in *Theateto*, and *Galen* in the sixth Chapter of his 7. Booke *de Placitis*) which yssueth from the first Sensator, that is, the Braine, and through the Nerues penetrateth into the particular Organs of the Senses, and there *Perceiue*th and iudgeth of all their alterations; is a common Faculty: and therefore wee call the braine the Common Sensator, and apprehension thereof the Common Sense. And thus much of the foure Senses (The first hauing beene discoursed of in the second Booke.) Now we come vnto the Voyce.

CHAP.

CHAP. XXXIV.

Of the Larynx or Throtle, which is the Organe
of the voyce.



The Rough Artery is diuided into the pipe which consisteth of Semicircular gristles with a membrane, and the head of it which we call the Larynx. It is called in Greek *ἀρὺξ* of *ἀρὺγιζω*, which signifieth to cry with open throat: or of the particle *λα* which of it selfe signifieth nothing but in composition adsignifieth a kinde of greatnesse, and the word *ἀρὺξ* to draw, because in the forming of the voyce we draw our breath deepe. Some call it *ἀρὺξ* but that is properly vsed for the Fauces or Chops; for the Pharynx is before the Larynx: others deriue it of *λα* and *ἀρὺξ* which signifieth to be lifted vp, because when we swallow or raise our voyce very high or vtter it very base, the Larynx is eleuated as any man may see with his eyes. Some call it the knot of the Throate.

The names & reasons thereof.

The Larynx therefore is the head or vpper end of the Rough Arterie ioyned in continuitie with the Fauces, compounded of great gristles (vnlike those that bee in the rest of the weazon both in the figure and magnitude) Muscles, Membranes, and common Organs: to be the first and most principall Organ of the tuning of the voyce; for in it the voyce is first formed.

What it is.

It is situated in the Necke, because it is the way of the Ayre, and in the very top of the Rough Artery that vnto it the breath which is the matter of the voyce might easily run vp from the lungs. Neere the Chops also, the mouth and the tongue that the voyce might instantly be changed into speech. Moreouer, because it was necessary that it should be perpetually dilated and constringed together with the Organs of Respiration therefore it was placed on the outside afore the Gullet, that it might not be pressed with the weight of any thing lying vpon it: yea and this position is a great furtherance to swallowing also. For when we swallow our meate the Gullet is drawne downward, but the Larynx resulterth vpward and helpeth the swallow, as wel by giuing way therto and leauing scope and roome, as also by depressing the meate when it starteth vp as that is falling. It is placed in the very middest of the necke because there is but one Throtle, as also other single Organes are placed in the middest, that the body might be equally ballanced. Now there was but one, that the voyce might bee but one. For if we should haue vttered two voyces at one time, wee could not but haue confounded two acts or affects of the minde.

The situation

And reasons thereof.

The figure is round and circular but imperfect, bunching out before, that it might bee more secure from outward iniuries, behind depressed, that it might giue way to the Gullet and leaue space to swallow. Again it was round, that it might bee concavous or hollow, that so the voyce might be more perfect by a plentiful affluence of the breath thervnto out of the lungs. The lower orifice also of the throtle is larger then the vpper (saith Galen in the second Chapter of his seauenth Book *de usu partium*) that in expiration the ayre might ascend more plentifully thereunto to make a base voyce. Finally, it is most like a Quail call of any thing in the world which indeed is made in imitation of this worke of Nature.

The figure.

The magnitude thereof is diuers according to the diuersity of the age, which variety the voyce also followeth. For in children when the Larynx is narrow the voyce is sharper, smal, or treble because a little ayre is swiftly moued through a narrow passage; on the contrary in old or elder age the Larynx is wider, and receiueth from the Lungs a greater quantity of ayre, whence it is that the motion is not so swift and so the voyce becommeth base, moreouer the length or shortnesse of the Larynx beare a great sway in the basenes or shrilnes of the voyce.

The magnitude

It is tyed to the rough Artery by the helpe of muscles, of Membranes, as also to the Gullet, the Chest, and the bone *Hyois*, moreouer to the principall parts by the mediation of common Organs.

The connexion.

The parts whereof the Larynx is compounded are Gristles, Muscles, Membranes, Veines, Arteries and Nerues, together with the Glandules which grew thereto. And it was necessary it should be compounded of such a substance. Gristly, that it might be hard, dense and thicke, able to resist outward iniuries. Again, because it is the way of the breath it was

The parts. Why Gristly.

fit

fit that the cavity should be made of a hard body that might alwayes stand open for egresse and ingresse of the Ayre. For (saith *Galen*) if it had beene made of flesh or a membrane, the hole of it would haue false and the passage should not haue bene so free for the breath and so the body haue beene depriued, not of voyce onely, but of life also, because the respiration would haue bene intercepted.

Why not bony

If it had bene bony the hardnesse thereof would haue pressed vpon the gullet and so haue hindred digestion or swallowing, beside the watery weight would haue drawne downe the tongue and the bone *Hyois*, and hindered their actions; it would haue needed great muscles to haue moued so heavy a body which must haue taken vp a greater place then in so narrow a roome could be allotted to them. And if the bones had beene so fine and thin that all these inconueniences had beene preuented, then it would haue easily bene broken being placed outward, for bones will not yeeld as gristles doe.

Columbus opinion that it is bony.

I know well that *Columbus* is of opinion that it is bony in growne men, which hee auoucheth vpon his owne dissection of innumerable bodies (those are his words) although hee confesseth that in young children it is gristly as not hauing attained his hardnesse and solidity. One argument also he addeth, which is, that the substance is medullous or marrowy as he hath often found, in which one thing bones differ from gristles. Hee also reprehendeth *Galen* for cutting vp Apes and not obseruing that their throtles were bony, and *Vesalius* for shewing the Throtles of beasts in his publike dissections. But *Fallopins* whom wee esteeme the more oculate Anatomist saith, that sometimes he hath found the first and second gristles bony in very old men, yea sometimes before extreme old age; but the third and the fourth gristles saith he, I neuer saw bony, neither can I approue of their opinion that thinke the Larynx is bony and not gristly, vnlesse it be imperfect, because Nature intended it to be bony. For (saith *Fallopins*) if this were so, then we must confesse that no man hath the instrument of his voyce perfect till he come to be old or stricken in yeares, which must not be granted. Of the same mind also is *Laurentius*.

Disproued by Fallopins.

Other reasons why it must be gristly.

Bauhine proceedeth further to prooue it gristly on this manner. It is the instrument of the voyce, and therefore there must be a proportion betweene the ayre that is beaten, and the body which beateth it, that so it may resound for the forming of the voice; for the voice is nothing else but a percussion of the Ayre. And although sounds doe arise from hard bodies not from soft, as a sponge, a Locke of wooll, or such like; for that the Ayre is not broken vnlesse it light against a solid, hard and smooth body; yet it must not be perfectly hard, for such an one doth not readily cut the ayre, but ouerturnes it. Nor too soft, for then it yeeldeth and maketh no resistance, and therefore cannot make any sound. Such a body therefore which yeeldeth moderately, and beateth the ayre gently, is the cause of the voyce, now such a body is a gristle. Finally, it was made gristly (saith *Galen* in the fourth Chap. of his Booke of the dissection of the instrument of the voyce) that it might be a fit foundation for the other parts whereof the Larynx is compounded: and that the Muscles might better arise therefrom and be implanted thereinto.

Not of one gristle.

But it was not fit it should be made of one entire gristle without any articulation, and so immouable, for then it could not haue bene either shut or opened, dilated or contracted. It was therefore made of many annexed one to another and hauing motion, not Naturall, such as is in the Arteries, but voluntary depending vpon the will. For the chiefe vse of it being in inspirations and expirations, it was meete we should be able to moderate it at our pleasures. Add hereto, that being the instrument of the voyce to admit or expell our breath it was more then necessary we should haue a voluntary command ouer it. To this purpose Nature also furnished it with muscles, and them with nerues for motion, veines for nourishment, arteries for life, and membranes for their strength. She added also glandules to keep them all moyst.

The number of the gristles.

It is made of 3. gristles (saith *Galen*) we say 4. so doth *Fallopins* and diuers others. The motions of the Larynx are double, (that is) whereby it is dilated and constricted, shut and opened; and therefore there was neede but of two articulations, each of which serue each motion. So that the dilatation and constriction is made by that articulation which is betwixt the first gristle and the second. The opening and shutting by that which is between the second and the third.

The muscles.

The Muscles of the Larynx are eyther common or proper, the common Muscles are fixe, that is, three paire. The first paire are called *Bronchij* [table 15. fig. 7. X X] because they cleaue to the rough Artery. The second paire are called *Hyoidei*, or rather *Hyothyroidei*, [tab.

Table 15. Fig. 7. X X
all the proper muscles
the backe parts
the fore side of
the muscles

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Table 15, Figure 3. sheweth some Muscles of the Larynx with a part of the Nerue. Fig. 4. sheweth all the proper Muscles, the Cleft, the Epiglottis or After-Tongue and the Gristles. Figure 5. sheweth the backe part of the Larynx with the Muscles separated, the Gristles and the Epiglottis. Figure 6. The foreside of the Larynx with some muscles. Fig. 7. the transuerse muscle of the Gullet, also 2. common muscles, together with the Recurrent Nerues.

TABVLA XV.

b, 4, 5, 6, 7, Epiglottis or the After tongue.
 * 4, The beginning thereof.
 †, 5, The roote and foundation thereof.
 cc, 5, The Gristle called *Arytenoides* or the *Ewre-gristle*.

d, 4, The *glottis* cleft or whistle.
 e, 4, The internall muscles belonging to the *shield-gristle* or the 4. paire of proper muscles
 f, The backward *Ring-Ewre* muscles, or the second paire of proper muscles.

g, 4, 5, The *Ewre-muscles* or the fift paire of the proper muscles.

h, 3, The muscles called *Hya-thyroides* or the 2. paire of common muscles belonging to the bone *Hyois* and the *shield-gristle* of the Larynx.

i, 3, 7, The Gullet.

k, 3, 6, The forepart of the rough artery.

l, 3, 7, The muscles of the Gullet called *æso-phagici* or the 3. paire of common muscles.

m, 3, A portion of the nerue descending into the second paire of common muscles.

nn, 3, 4, 5, The *Shilde-gristle*, parted in the 4. figure that the *Glottis* and the muscles might better be seene. In the 5. figure is shewed the Hollow side of the *Shield-gristle*, in the sixt the outward and the foreside.

o, 4, The cavity or ventricle.

r, 4, The laterall *Ring-Ewre* muscles or the 3. paire of proper muscles.

s, 4, 6, The forward *Ring-shield* muscles or the first paire of proper muscles. In the 6. figure one of them is separated, the other remaineth in his owne place.

t, 5, The spine or ridge of the *Ring-gristle*.

u, 6, A cavity in the midst of the *shield-gristle* made for the *Epiglottis* or After-tongue.

xx, 7, The muscles of the weazon or the first paire of common muscles. yy, 7, The recurrent Nerues.



FIG. VII.

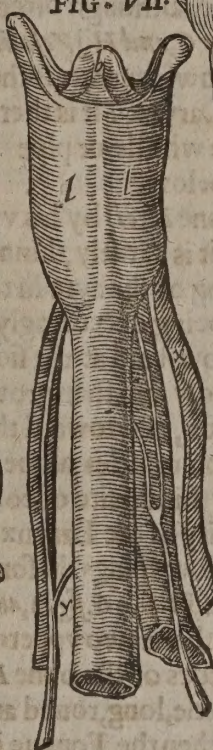


FIG. V.



FIG. IV.



FIG. VI.



[tab. 15. fig. 3. b.] The third paire are called *æso-phagici* [tab. 15. fig. 7. l.] The proper muscles are ten or five paire, of which fixe doe dilate and foure do constrict. Some of these are placed forward, some backward, some without, some within.

The 1. paire we call the forward *Crycothyroides* [tab. 15. fig. 4. s, but in the 6. Figure the one is separated, the other remaineth in his proper seate.] The second paire we call the backward *Crycoarthenoides*. [tab. 15. fig. 5. l.] The 3. paire are called the laterall *Crycoarthenoides*. [tab. 15. fig. 4. r.] The 4. paire are called the Internall *Thyroides* or *Thyroarthenoides*. [tab. 15. fig. 4. c.] The 5. paire are called *Arytenoides*. [tab. 15. fig. 4. and 5. g.] The larger description and vse of these muscles looke for in the Book of muscles. We will come to the gristles of the Larynx which wee will handle particularly in this place because they make this notable Instrument of the voyce, and touch them but by the way in the discourse of gristles.

The Larynx therefore consisteth of 3. gristles say the Ancients, of 4. say many of the latter Anatomists, and we may so esteeme them: one called *Thyroides*, the other called *Crycoides* and the 3. *Arytenoides* which is double. These gristles when the muscles are removed from their outside are somewhat rough or rugged, to yeeld to the muscles more commodious originall and implantation. But on the inside they are smooth as being inuested with a Membrane, and beside smeared over with a slimy moysture. Of these gristles 3. are moued in the modulation or tuning of the voyce, that called *Crycoides* is immouable. The 1. and the 2. when men grow old become so hard that some good Anatomists haue thought them bony. But we haue proued before that they must needs be gristly not bony.

Iij

The

The names
of the gristles:

The 1. gristle.

The first is called in Greeke *σπουδιδας* the *Shield-gristle*, or *ἀσπίδιδας*, for *ἀσπίς* signifyeth a Buckler or Shield. It hath his name from the forme, [tab. 16, fig. 2, and 3, whole] for it is like the Target that the Ancients were wont to vse that was not round but long, the forme is yet kept by Heraldes and in triumphs where painted Shields are vsed of this fashion, the belly a little hollow and the back gibbous. This gristle lying vnder the bone *Hyois* couereth the forepart so as we can touch it, especially in men in whom it buncheth out more then in women, which bunch or knob they call *Pomum Adami*, *Adams Apple*, as if it sticke still in the throate of al his posterity, whereas the woman swallowed it well enough. But the true reason why it appears in men and seldome in women, is because the glandules which are placed at the Larynx doe make their necks equall and euen.

Pomum Adami

Why womens
throates do not
peare as mens

It hath foure sides because of the foure processes it hath behinde, for on the back it is not ioyned by the sides. In an Oxe (saith *Placentinus*) there are two manifest perforations aboue, through which the proper muscles of the Larynx receiue propagations of the Recurrent sinewes.

But one gristle

It is but one gristle, although oftentimes there runne a line through the middest. [tab. 16, fig. 2, and 3, betweene G, and H] *Vesalius* esteemeth it two, in men particularly, *Laurentius* especially in women; howsoeuer, it is the largest and broadest of all the rest, as taking vp the one halfe of the whole Larynx: it is therefore threefold as bigge as any of the other compassing the Larynx and the whistle or pipe thereof which wee call *Glottis*. Moreover in a man it is larger aboue then below.

Connexion.

It is tyed to the bone *Hyois* by his vpper processes, and by the lower to the 2. gristle.

Substance.

The substance of it is Gristly, thinne yet hard, the better to defend the *Glottis* or whistle, and to helpe the breaking of the ayre in the forming of the voyce. In old men this gristle is sometimes so hard that being exceedingly drier it becommeth Bony, yea sometimes a very bone. It beginneth to grow hard at the sides, the middle line remaining Gristly for the most part, yet euen that also now and then groweth to be a bone. The exterior superficies of this gristle is conuex or gibbous, and toward the ends of the sides it is rough, into which place the first paire of the common muscles of the larynx are inserted, as also those take their original which we account for the third paire of common muscles of the gullet. On the inside it is hollow to forme the long cavity of the Larynx, by which meanes the voyce becommeth full & elegant, for we see that hollow things do sound better then plaine, as it is in bells.

4. Processes.

It hath 4. processes, [tab. 16, fig. 2, and 3, IKLM] two aboue and two below, on each hand of the sides one. With the two vppermost [tab. 16, fig. 1, IK] it is tyed by a ligament somewhat long to the lower sides of the bone *Hyois*; [tab. 16, fig. 1, BB] which by certaine distances is strengthened with little, long, round and gristly bodies, [tab. 16, fig. 1, aboue K, I] especially it hath vse of them when the Tongue is put out or drawne in again.

The two lower processes in men are shorter then the vpper (but in Sheepe quite contrary) [tab. 16, fig. 2, and 3, LM] and are articulated by *Arthrodia* [tab. 16, fig. 1, from L, to I] with a flat head to a shallow cavity in the second gristle, that the *Shield-gristle* might be moued vpperward and downward.

The cavities.

On either side nere the processes it hath certaine recurued or bowed cavities. The vpper of which being in the middest [tab. 16, fig. 2, and 3, G] is the lesser, made for the *Epiglottis* to raise it vp easily and suddenly. The lower are on each side one [on both sides at H] whereinto the anterior muscles are implanted. [tab. 15, fig. 6, f] Finally this *Shield-gristle* is mouable, partly by articulation, partly by flexion. The Articulation may be called *Arthrodia*, by which it is drawne length-ways vpperward and downeward, and these ioyns are at the lower processes which are ioyned to the second gristle, the draught is made by the first and second paire of the common muscles. It is also drawne in length without a muscle being compressed by the three paire and loosened by the flexible substance of the gristle. It is also mouable by flexion, for because it is thin it is also flexible, whence it stretcheth in breadth, it yeeldeth downeward and againe returneth vpperward, and so the cavity of the Larynx is lifted vp and depressed, straightened and relaxed.

The vses of the
Shield-gristle.

The vse of this gristle is foure-fould, the first to make the cavity of the Larynx, the second to establishe the *Glottis* or whistle, the third to affoord an implantation or seate of rest for the muscles. And finally, to fashion out the articulations necessarily required in the motion of the Throtle.

The 2. gristle.

The second and lower gristle is called *κεκλιδιδας*, the *Ring-gristle*, [tab. 16, fig. 4, 5, and 6,] for so *Galen* and *Oribasius* his *Epitomizer* call it because it is like a Ring: and indeed it is very like

like that bony ring which the Turkes weare vpon their right thumbes when they shoot, that they may draw the bow string with greater strength. It is commonly called *Innominata*, the Gristle without a name, because the Ancients before *Galen* gave it no name, the reason hee giues *de dissectione musculorum*, because they could liken it to nothing in the whole world; haply saith *Banhuine* because the actions of the *Larynx* are performed by motion, now the other three do moue, but this being as it were the Basis and foundation of the rest is altogether immouable.

Why called *Innominata*.

It lyeth vnder the *Shield-gristle* and is the Basis of the other gristles which it sustaineth. It lyeth vpon the first gristle of the rough artery to which it is ioyned by a ligament, & the greatest part of it is in the backpart of the *Larynx*, yet it compasseth it round about like a ring, establishing it by his hardnes. And it was very necessary it should be like a ring or perfect circle, partly that the pipe might be alwayes open, and so way made for the ingresse and egress of the Ayre, otherwise in the motion of the *Larynx* the semicircular gristles of the weazon would haue beene compressed: partly lest when the gullet is dilated or stretched by the swallowing of any hard and thicke substance, the pipe or weazon which is the way of the breath should be compressed, whence suffocation or strangling must needs follow. On the outside & fore side it is gibbous, narrow, slender and round like the other gristles of the weazon. [tab. 16, fig. 4, and 5, R] Gibbous the better to defend it selfe, to helpe the shield-gristle to make the cavity, to helpe the sound and to dulcifie it. Thinner that it might not hinder the ayre that was to be driuen vnto the shield-gristle; for if it had in this place beene broader, then had the shield-gristle wanted place to moue it selfe in. But behinde where it doth not compass the shield-gristle it was fitte it should be broader, and so well might be; [tab. 16, fig. 4, 5, and 6, S] broad I say like the head of a ring whereon the scale is grauen, and flat: otherwise the roundesse of it together with the hardnesse would haue hindred the swallow.

The situation

And reason thereof.

The figure.

The substance.

Moreover it is also thicker, especially towards the vpper part, and that because of the articulation; and that the slit and the whistle might be on euery side defended and established: adde hereto another reason why it was thicke, to wit, that from thence some muscles might take their originall. For in the very middest which is the broadest part there standeth vp a rough line [tab. 16, fig. 6, T] which *Galen* in the 7. chapter of his Booke *de dissectione vocal. Instrum.* calleth the *Spine or the ridge of the gristle without a name*. By this line is made a shallow cavity on each side [tab. 16, fig. 6, V X] wherein the second paire of proper muscles are commodiously situated. But in the vpper and backward part it hath on each side a long knob [tab. 16, fig. 6, Y Z] or if you had rather call them bunching processes (*Galen* calleth them *Shoulders*) with which the *Ewre-gristle* [tab. 16, fig. 9, "] is articulated; in which place it is alwayes harder & thicker; so that that which seemed in childhood gristly in the middle or growne age becommeth (or at least seemeth) to be bony. In the middest it also swelleth a little on both hands & becommeth thicker [tab. 16, fig. 6, N O] and excauated, in which cavity the lower processes of the *Shield-gristle* whose heads are flatted, are strongly ioyned to this ring gristle by a plaine articulation. Finally, in the lower part [tab. 16, fig. 4, 5, 6, S] there runneth downward a kind of proceffe, from whence the third paire of proper muscles do arise.

The quantity.

This ring gristle by how much it is lesser then the *Shield-gristle*, by so much it is greater then the *Ewre-gristle*: it is also somewhat narrower then the lower Basis of the weazon, wherefore the lower part of the *Larynx* is larger then the vpper orifice which is in the chops. It is the hardest and the thickest of all the rest (although it be not all of an equall thicknes) because the others rest vpon this as vpon a Basis; wherefore also it is immouable that vpon this the other gristles might be both moued and articulated, and the muscles which belong vnto the others herein also firmed and established.

The connexion.

It is tyed to the *Shield-gristle* by the helpe of membranes or ryes produced from the 1. to the 2. these ryes are double, as also are those which couple the 2. with the 3. as *Galen* teacheth in his Booke *de voce & anhelitu*, and these membranes do inuest not onely the middle part of this Ring-gristle but also the whole Basis of this *Shield-gristle*.

The 3. gristle. It is indeed double.

The third Gristle of the *Larynx* is in the sides [tab. 16, fig. 7, 8, 9,] and is called *apud Graecos*, that is, the *Ewre*, because it is like an *Ewre* out of which water is poured if you marke the two vpper processes couered yet with their membrane, or because it is like the spout of a wine por. This is commonly esteemed and receiued for one gristle, because they are not wholly separated, & performe their action together not asunder. Whilst it is yet couered with his coate it is like an imperfect Triangle: but if you take off the membranes wherewith it is couered, you shall perceiue that it is made of two gristles [tab. 16, fig. 7, 8, 9, 10] which aboue and below, are

loosely ioyned by the mediation of ligaments and of the membrane that compasseth the *Larynx*, but in the middest they cleave asunder or stand separated. In the middest where it is thicker it hath a ioynt whereby it is ioined to the top of the ring gristle where it regardeth the gullet: and because the gristle is double the articulation also is double, which do on each side receiue into their cavities [tab. 16. fig. 8, 9, 11] the swellings of the ring gristle [tab. 16. fig. 6, 7, 8] that so it might the fitter be straightned and dilated.

The substance.

The substance of this third gristle differs, from the other two, as being softer, that it might not need the greater muscles to moue it; it is also slenderer, fatter and moyster that it might not be dried vp by the ayre, much lesse also then the rest, that the passage should not be angustated or straightned.

The processes vpper.

It hath processes aboue and below. The vpper [tab. 16. fig. 7, 8, 9, 11] which being ioyned do cary the fashion of an *Emre* or spout pot, are recurued outward, that they shold not incline inward and so fill vp the cavity, whereby the free passage of the breath would haue beene interrupted. They are lax, soft, fat and flexible, that they might follow the motion of the whole glottis or whistle. These vpper processes are not altogether separated asunder, least one shold

Table 16. Figure 1. Sheweth the whole Larynx composed of his gristles with the bone *Hyois*, and a part of the *weazon* or pipe. Figure 2. and 3. Sheweth the *Shield-gristle*. But 4, 5, and 6. Figures shew the *Ring-gristle* or that which is without name. Figure 7, 8, and 9, sheweth the *Emre-gristle*. The 10. the *Epiglottis*. The 16, sheweth the gristles of the *weazon*.

TABVLA XVI.

A, 1, The bone *Hyois*.

BB, 1, His processes.

C, 1, Gristly swellings and membranous ligaments set by course to which the *Shield-gristle* is ioined by processes.

D, 1, The laterall *Shield-gristle*.

F, 2, and 3, Sheweth either face of this gristle.

From G, to H 2, 3, A line in the midst of the first gristle.

I, K, 1, 2, 3, 4, The vpper processes of the *shield-gristle* articulated to the bone *Hyois*.

L, M, 2, and 3, The inferior processes of the same *shield-gristle*, which in the 1. figure are articulated to the *Crycoides* or *Ring-gristle*.

N, O, 6, The seat of the *crycoides*, or *ring-gristle* where these processes grow into one.

P, 1, 5, The backe part of the *Ring-gristle*.

Q, 4, 5, The inside of the *Ring-gristle*.

R, 4, 5, The lower circular region of the *Ring-gristle*.

S, 4, 5, 6, The hinder part of this circle.

T, 5, 6, A hinder line of this gristle.

V, X, 6, A bosome on both sides this gristle called also *ventriculus*.

Y, Z, 4, 5, 6, Two swellings of the *Ring-gristle* which goe into the bosome of the *Emre-gristle*.

a, 1, The *Arytenoides* or *Emre-gristle*.

b, 7, 8, 9, Two parts of the *Emre-gristle*.

c, 8, 9, The empty space of this gristle which is couered with membranes.

d, 8, 9, The sides of this gristle by which it is ioyned to the ring gristle.

e, 8, 9, A proesse of this gristle making a little tongue.

f, 9, the vpper part of the 3. gristle like a spoutpot or an *emre*

g, 10, The basis of the *Epiglottis* regarding the Larynx continued with the *shield-gristle*.

h, 10, The tip of the After-tongue regarding the palate.

i, 10, The basis & top of the *Epiglottis* regarding the palate

k, Both sides of the gristles which make the pipe of the Rough-Artery much like the Latine C.

l, 1 The Rough-Artery.

m, 1, The membrane which on the backside, tyeth together the gristles of the *weazon*.



haue beene drawn from the other, and therefore in a man they are aboue ioyned with a membrane; but in Hogs it seemeth to be indeed but one proceffe. This part is so soft and flexible that when a man vomits it is reclined forward into the Larynx, and so shutteth the artery exquisitely, that no thing might happen to fall down into the lungs in our vomiting.

The lower proceffes made the *glottis*, or slit, or whistle by which the voyce is tuned. In that part they are wholly diuided [tab. 16, fig. 7, and 9, 2] because it was fitt that the slit or *glottis* should be mouable and free. For vlesse the egress of the breath be narrow the voyce cannot be formed. These proceffes also in the middle of the cavity of the Larynx are couered ouer with a fat membrane, whereby the slit is made the more firme. This *ewre-gristle* is made mouable, because without motion the Larynx cannot be streightned, and againe dilated; & therefore on either side in the lower end there is a muscle inserted.

The motion proceeding of the Articulation of the *ewre-gristle* with the *Ring-gristle* is fourfold. Flexion, Extension, and Motion to both sides; and so it is moued vward, downeward to the right hand and to the left. By flexion the *ewre-gristle* is driuen into the cavity by the 4. paire of proper muscles to shut the slit. By extension it is reuelled outward by the 2. paire of proper muscles to open the slit. Again, by the motion to the sides they are conioyned by the 5. paire of muscles to constringe it, as by the 3. paire they are separated to dilate it.

Now betwixt the flexion and extension of the *ewre-gristle* and of the rest, there is this difference, that in the others one motion is made for the behoofe of an other, but in the *ewre-gristle* both motions are of themselves profitable: the flexion, to constringe the slit that so the breath might be kept and the voyce formed at our pleasure; the extension to dilate it againe that the ayre might be plentifull received in.

The membranes which tye the gristles together do make certaine bosomes or cavities betwixt the *ewre* and the *shield-gristles*, into which, if in eating or drinking any thing fall, bee it but a little beare, which often hapeneth when the *Epiglottis* or *ouer-tongue* by laughter or speech when wee are eating is opened, whatsoever it is, I say, that passeth against our breath causeth a coughing. Of these bosomes or *sinus*, *Galen* seemes to make mention in the 11. chap. of his 7. Booke de *usu partium*, but since *Galen* (saith *Scuerinus Pinelus*) neuer any man made mention of them, but *Gasper Bauhine*, but where *Laurentius* had them I know not. *Placentinus* hauing got the hint of them, as should seeme from *Bauhine*, hath examined them very diligently in brute beasts and findes them seldome saue in Swine, Horses and Dogs. *Aquapendens* professeth that he findes them in all creatures vfed to the earth, but in some lesser, in some bigger; yea, so bigge as a man may put his finger downe them. Swine and Horses haue the largest, those of men are not so deepe.

The vse of these *sinus* is to alter the attracted ayre that it fall not with violence vpon the Larynx, such as is the vse of the deafe eares of the heart. They helpe (saith *Aquapendens*) to retaine the breath when the whole *glottis* is shut vp. In Dogs these *sinus* are like ventricles.

CHAP. XXXV.

Of the Glottis and Cleft of the Larynx.

That which is called in Greek *γλῶττις* is that body which maketh the Cleft or Fissure in the Larynx, which is the chiefe Instrument whereby the voyce is formed and uttered. [tab. 15, fig. 4, d] It hath the name from the likenesse that is betweene it and the tongue of a flute or other pipe. The Latins also call it the *Little Tongue*. For as the sound is made by the tongue of a pipe, so the voyce is made by the Linget of the Larynx, and as a man speaketh by his tongue, so the pipe is said to speake as it were by this *Glottis*; therefore we call it the *Whistle*.

It is situated within for the better generation of the voyce, and because the instrument might be freer from outward iniuries.

The figure of it is Ouall, sharpned at either side, yet more toward the *shield-gristle*, then toward the *ewre-gristle*. It is as long as the Larynx, as well that the gristles thereof might establish it, as also that a man might vary with his voyce high, low, or in a middle key, or as we say Treble, Base or Tenor: adde hereto that being so long it is able to admit a sufficient quantity of ayre. Morcouer as there is but one Larynx so there is but one *Whistle*, or cleft which beginneth

Lower.

The motion of the gristles to what vse they serue.

The sinus or cavities betwixt the 1. & 3. gristles.

Bauhine first made mention of them.

Their vse.

The Glottis.

Situation.

Figure.

neath from the *ewre-gristle* & endeth into the *shield-gristle* that so it might be moued with voluntary motion, for we said before that only these 2. gristles were mouable, the middle which is the *Ring-gristle* is immouable.

How it is di-
uided.

Notwithstanding it maybee diuided into that which in the vpper part is made especially of the parts of the *ewre-gristle*, and that which in the lower part is formed of the membrane duplicated. This *glottis* and cleft runneth in the middle of the *Larynx* directly from the fore side backward, that the ayre yssuing out of the cleft and formed into a voyce might instantly touch vpon the top of the palate and the tip of the Tongue by them to bee articulated. And as the slit or cleft of a pipe is sometimes broad and long, sometimes narrow and long or short, so is it in this. For if it be long and broad, the voyce is base, if it be narrow it is treble or shrill: yet the magnitude is proportionable to the body; large bodies haue large slits, and litle bodies narrow, from whence comes the differences of voyces.

The composi-
tion of it.

The composition of it is very artificiall that the ayre which is the matter of the voyce might easily ascend and descend, and might beside receiue a fit repercussion. For it is made of both the processes of the *ewre-gristle* [tab. 16, fig. 7, 33,] or of the double *ewre-gristle*, and a portion of that muscle of the *shield-gristle* inserted into the processe of the *ewre-gristle*, which two are inuested with a membrane (making the Inner cleft, of which we shall speake by and by) which is not only thight to defend it but also moyst, which moysture is not only slimy but also fatty: and yet this *glottis* is moystened with a proper moysture of it own, lest our voyce should soone faile in discourse or other vse of it, if the *glottis* and the parts belonging to the *Larynx* should be exiccated. For being of a membranous substance, the frequent motion thereof in our speech or vociferation, the perpetuall ingresse of ayre & egress of the breath which is hot, might haue dried it if Nature had not prepared a proper moysture to keepe it in Temper: for as wee see whistles and pipes do need euer and anon to be moystened or else they will not sound so well, so if this *Whistle* of the *Larynx* had not had a naturall moysture, the voyce must needs haue fayled as we see it doeth in those that are sick of burning Agues, or trauell in hot weather, who cannot speake before they haue moystened their throates, or if they speake their voyce is stridulous or whining, which kind *Hippocrates* calleth *voces clangosas* in *Prorrh.*

Vox clangosa.

This moysture maketh the surface of the *glottis* or whistle to be slippery, yet is it beside smooth and glib, least the ayre lighting vpon vnequall parts and so yssuing vnequally should make the voyce harsh and vnplesant. Notwithstanding it was fit this moysture should be moderate, because those bodies that are too wet do sound worse then those that are dry. Whence it is that in rheumes and murrhes the voyce is hoarse, because the *Larynx* is dewed with too much moysture, but when the moysture thereof is Naturall it mayntayneth the voyce a long time without helpe, the rather because as we said, the moysture is not thinne that it should soone be spent, but viscid and fatty. And haply this made *Galen* say that the *glottis* was not onely membranous, but also fatty and glandulous. The *glottis* also by this meanes being soft and supple is more easily dilated and contracted, for it was necessary it should open and shutte as might serue best for the different expiration of the breath.

How the
voice becom-
meth hoarse.

Galen.

The rest of
the Glottis.
The motion
thereof.

For the *glottis* is either at rest or is moued, when it is at rest it serueth for the inspiration of ayre; when it is moued it is the instrument of the voyce, for the forming whereof it hath a double motion, one of dilatation another of constriction. The dilatation is the cause of deepe and baser voyces; the constriction is double, eyther to make the slit narrow and then the voyce is treble and soft; or altogether to shut it vp, whereby the breath is violently retained within, as when we strue to lift great weights, when women are in the pinch of trauel, & in such like violent actions. Wherfore as it is musculous it maketh the motions of dilatation and compression; as it is gristly it affordeth the ioints whereon the motion is made, and strength to support the motion that it should not be ouerturned by the breath; as it is membranous it is more fit to be dilated and constricted, the slit is formed the better and the muscle is defended.

The inner slit.

But beside the slit made by the *ewre-gristle*, in the inner cavity (and that in men only) there is formed another slit of the concourse of two membranes. For from the fore and middle part of the *Shield-gristle*, the membrane where with it is inuested on the inside in the middle iust against the *glottis* becommeth double and more solid, and attaining ouer to the backside of the *Larynx* is tyed to the inside of the *Ring-gristle* not farre from the *ewre-gristle* that so it might be kept stretched. Betweene these duplicated membranes there remaineth a long cleft running from the backside forward [tab. 16, fig. 7, 8, 9,] which is made broader when the *Shield-gristle* is dilated by the muscles, and so the voyce becometh base: as on the other side it is treble if it be angustated or streightned. And this is holpen by the diuision of the *glottis*, for both slits are

are

same time dilated, & at the same time constringed. *Arantius* maketh mention of this internall slit, and is of opinion that it is the chiefe place wherein the voyce is tuned, and that the division of the *glottis* is but assistant thereunto.

The use of the *Glottis* is, to be the chiefe Instrument of the voyce, or principall part in the *Larynx* which performeth the action, that is, the voyce; for that is the proper action of this Instrument. For the ayre passing is retayned and broken, and so produceth the voyce neyther can any voyce be made vnlesse the passage be straightned (and therefore *Galen* said well, that the *Larynx* without the *glottis* cannot frame or forme a voyce, no more then the eye can see without a cristalline) now it is straightned when it is moued, that is, when it is dilated or contracted, for it is in our power, saith *Galen* in the 9. chap. of his 8. Book *de placitis*, to shut or open the mouth of the *Larynx* when wee will, and as we list to close or loosen it, so wee make our voyce base or treble; for if we let our breath passe out lightly and gently, no sound accompanieth our expiration, but if the breath be powred forth suddenly & vehemently, then with the expiration there issueth a voyce also.

The use of the
Glottis.
The chiefe in-
strument of
the voyce.
Galen.

We may
breath with-
out a voyce.

CHAP. XXXVI.

Of the Epiglottis or After-tongue, and his Muscles.

That which the Grecians call *ἐπιγλωττίς* because it is set about the *glottis* or whistle of the *Larynx*, the Latins call *minor Lingua* or *Lingula fistula*, but because the *glottis* is also called *Lingula*, we haue rather called it the Aftertongue. It is a gristle and a couer of the cleft of the *larynx* made to fall vpon it when we swallow, that nothing should slip aside into the weazon [tab. 17, it is placed betweene the first and second figure, but inuerted and was cut away from fig. 1, at aa, but tab. 15, fig. 4, 5, 6, b.]

Hippocrates
callet it.
claustrum the
locke or thaspe
What it is.

Aristotle in the twelfth Chapter of his second Booke *De Historia Animalium*, thinketh that all creatures which lay Egges doe want this *Epiglottis*, but doe close exquisitely or dilate againe the top of the *Larynx* as they please to keepe any thing out of their longues without any use of such a couer as is necessary in other creatures. *Placentinus* addeth that Frogs haue none of it.

It is seated betweene the *Larynx* and the tongue, and if you looke vpon the superficies of the membrane that compasseth the tongue which is continuall with this *Epiglottis*, it may be esteemed to be as it were a part of the tongue: whereupon some haue thought that it hath his originall from the roote of the tongue, whereas it is more likely that it arises from the *Shield-gristle*. For it ariseth vpward with a large Basis recurued forward from the inward and higher part of the *Shield-gristle*; [tab. 15, fig. 4, *, fig. 5, +] afterward it grows broder a little and a little, & becometh like a round Arch, but in brute beasts it is by degrees angustated & determineth into a broad and sharpe edge. In the Basis thereof it is tyed to the *Shield-gristle*, all the rest of it is loose and hangs at liberty.

The situation
Connection.

The forme as saith *Hippocrates* in his 14. Book *de morbis*, is like the luy leafe, for the Basis is broad and arched forward into a roundnesse, or it is like a little tongue as *Pliny* & *Celsus* write. *Vesalius* compares it to a triangle. *Columbus* to a little shield curued and straightened toward the edge. *Aquapendens* to a triangle which hath crooked sides.

The forme.

The vpper part called the backe which is next vnto the palate, is a little conuex & buncheth outward, the lower side which is next to the cleft or whistle is hollow or a little concuous. The breadth of it is not only enough to couer the cleft but to spare.

It is also of it owne Nature rigid and stiffe standing, that the pipe of the rough artery might remaine open, least the heart should be suffocated; yet is it flexible that it might perfectly shut vp the cleft ouer which it is disposed: beside, if it had not beene flexible the waight of the meat and drinke would not haue depressed it in the swallowing: againe, if it had not been stiffe and rigid, when it is once borne downe vpon the cleft in the swallowing of meate, it would not haue started vp againe to giue way for the yssue of the breath. Wherefore the substance of it is gristly and thin, somewhat softer then the other gristles, yet so, that it is softer, thinner and more flexible on that side that respecteth the palate, especially in the very end nere the gullet it is very soft, and couered with a fat membrane. For when the creature breatheth it is lift vp of it own accord to make way for the ayre, but when he swalloweth it coucheth vpon the *Larynx* least the meate should fall into the Lungs.

Rigid or stiffe.

Yet soft too.

For

The reason thereof.

For that which is swallowed (as *Galen* well hath written in the 16. chap. of his 7. Booke *de usu partium*) falleth 1. vpon the roots of this Astertongue, after it is carried vpon the backe of it which maketh it to cough or incline. These motions this *Epiglottis* could not haue had if it had bin eyther membranous or fleshy, because it would haue alwayes lien depressed, or being once depressed it would hardly haue beene raised vp againe, neuer erected vpright. Neyther could it haue beene bony, for then it would alwayes haue bin rigid, neyther could it haue bin depressed with the swallowing of meats and drinks. Wherefore with *Galen* wee think that the motion of the *Epiglottis* or Astertongue in a man is naturall, and that the cleft is couered and againe vncouered, not by the helpe of muscles but by the waight of those things which we eate and drinke.

The motion of it in men. Naturall.

In some beastes voluntary.

But in Beastes that chew the Cud there are some muscles found, as we shall say in the History of the Muscles and shew them somewhat particularly, because it is an ordinary thing for yong practitioners in Anatomy, to exercise themselves in dissecting of the Throates of Oxen and such like: But in the meane time wee must remember that the *Epiglottis* is couered ouer with a fat membrane much like to the nature of a ligament, which at the *Shield-gristle* is full of fat.

The vse of the *Epiglottis*.

The vse of the *Epiglottis* is to couer the *glottis* or whistle when we swallow our meate, for if at vnawares any of the meate do slip into the wezon, we presently keake and are near strangling till by coughing it be gotten vp againe, the reason is, because that which descendeth taketh away respiration. So *Anacreon* the Poet was strangled with the stone of a Reysen. And *Fabius* the Senator drinking a cup of Milke was choaked with a haire that was therein.

Part of the drinke gets into the wezon.

An instance.

The vse of peritorall Medicines.

Alexander Benedictus tells of a woman who would haue giuen her Son a Pill and was constrained to thrust it downe his throate with her finger, she thrust it into his wezon & he died instantly. Because therefore a man cannot liue without Respiration, when that Respiration is interrupted Nature rowseth vp her selfe to make resistance, and so we straine at the least crum that fals the wrong way. Yet wee must not imagine that the cleft is so exquisitely closed but that some part of the drinke slipperth into the rough artery, gliding downe by the side of the *glottis* though it be not felt. And this way we thinke distillations doe yssue out of the head into the Lungs, which though they be very abundant yet he that is sicke cannot feele them, especially in sleepe they gather very fast together. How *Hippoc.* proued that a part of the drinke is conuayed vnto the Lungs, we haue before shewed by the cutting of a Hogs throate instantly after he had drunk water colored with Vermilion or any such like, for you shall finde the very colour in his wezon. Again, if some of the drinke did not slip downe by the sides of the rough artery, it were in vaine to prescribe Eclegmes, Syrups or Lozenges in affects of the chest. But we finde by experience that all these doe helpe expectoration and make the spittle come vp more roundly, if they be taken by little and little the head reclined backward, licked off a knife, a Liquerize stick or such like, or if the Lozenges be conteyned in the mouth till they melt of themselves and passe insensibly into the *Larinx*. And heerein we imitate *Galen* in the 7. chap. of the 4. Booke of his method, where being to cure one that had an Vlcer on the inside of the rough artery, caused the Patient to lye vpon his backe, and a moyst Medicine that was fit for the Vlcer to be giuen and to be held in the mouth as long as he could, and to relax and remit the muscles of the place, for so saith *Galen* by little and little some of the Medicine will distill into the artery.

Tab. 17, fig. 1. sheweth the *Larinx*, hauing the *shield-gristle* cut into 2. parts, but one part of it together with the *Epiglottis* is innerted, as by the Letters may be perceined. Fig. 2. exhibiteth the *Larinx* shewing the *glottis*.

TABVLA XVII.

FIG. I.



FIG. II.



- a, 1, The *shield-gristle* dissected.
- b, 1, The *Epiglottis* or astertongue.
- c, c, The *Arytenoides* or the *Ewre-gristle*.
- 1, 2, The *glottis* or small cleft of the Throate.
- e, 1, The internall muscle forming this cleft or the internall *Shield-gristle*.
- f, 2, The opening muscle of the latter *Corycoarythanoides*.
- g, 2, The transuerse muscle or the *Arytenoides*.

But

But the reason why water or drinke when it falleth into the weazon causeth a cough is, because as *Hippocrates* saith it maketh a disturbance for that it opposeth the respiration. For the liquor that falleth down by the sides of the arteries, doth not withstand the egress of the aer, rather it furthereth it by making the way moyst & slippery. Hence we may see how ignorant the Ancients were in Anatomy, as *Plato*, *Philistones*, *Dioxippus*, and such like, who conceived that the drinke went into the artery or weazon, and so into the Lungs, and the meate through the gullet into the stomach. Against this opinion *Hippocrates* disputeth in his 4. Booke *de morbis*, that is, against those that think the drinke falleth into the Lungs, yet he doth not deny but some drinke sipeth that way as we haue said before. Wherefore (saith *Galen* in the 9. chap. of his 8. Booke *de Placitis*) if *Plato* thought that all the drinke was conueyed into the Lungs hee cannot be excused because his ignorance is euen palpable: but if he thinke that a part of the drinke is deriued into them he is not altogether deceived.

Why we cough
when any
thing falls into
the weazon.

The like we may say of *Aristotle*, who thought it an error to say that the drink passed into the Artery because there is no thorough passage for it, as there is out of the stomacke into the draught. For verily if that be auouched of all the drinke it is a very absurd conceit: but if it be meant of a little it seemeth to be true.

Aristotle.

Another vse of the *Epiglottis* or after-tong is to strike the aer which ariseth from the Lungs into a tuneablenesse, especially if it arise with a force or impetuous violence thereunto. And this vse we haue out of *Laurentius*.

Another vse.

CHAP. XXXVII.

Of the Membrane of the Larynx or Throate which is the Ligament thereof.

THe Larynx is bound about with a Membrane which is common with the membrane of the mouth, to be a defence to it both outwardly and inwardly, and whereby the ayre being gently and easily stricken, might make the voyce pleasant and moderate. First inwardly, the whole cavity is compassed and so it is led ouerthwartly to the vpper part of the Larynx, being diuided in the middest of his length it maketh a little cleft. But outwardly it doth partly encompassse the external superficies, and partly it inuesteth inwardly the gristles and muscles.

The membrane
of the Larynx.

They are steeped in a certaine slimy humidity, partly least the Respiration being warme, smoky and dry, should make the parts dry also, partly that the *Epiglottis* might be closely ioynd to the glottis and so his exiccation might be hindred, which humidity is more abundant within, yet so that in those which are found it is neither more copious nor more scarce then the Instrument of the voyce doth require; by it also it is polished and so the voyce is made pleasant and equall, for being moystned with a kind of humidity it doth familiarly beate the ayre, whence the sweetnesse of the voyce proceedeth. This may be prooued by the example of Musicians, who going about to sound longer Pipes or Trumpets whether they be of Brasse of Wood, will somewhat moysten them (haply with their spittle) whereby the voyce may bee more delectable, else because of too much siccity the sound is not onely vnpleasant and harsh, but is made with more difficulty and labour; like as if it bee too moyst the sound is obtruse, wherefore wee said before the voyce is made hoarse by the humors which come out of the Braine into the Choppes.

Why the mem-
branes of the
Larynx are
moyst.

Whence a
pleasant voyce
proceedeth.

These Membranes of the Larynx are for the most part thicker and stronger then all the rest. The outward is very crasse and lax and as it were rough and rugous, for aboue the *Epiglottis* it is lax and crasse, where it is bound to the sides of the 3. gristle, and betwixt it and the gristle, especially at the basis, there is a little Fat growing. It is lax, that it may more easily bee incurued and turned vpon the Larynx and be moued in deglutition or swallowing, in an acute and graue voyce vpperward and downward. And it is crasse, somewhat hard also and dense, because by that way meate sometimes halfe chewed, hard and in great gobbits must passe of necessity.

Why they are
crasse & thick.

Why they are
lax.

Some there be which thinke that this Membrane is increased with fleshy fibres, and that it becommeth a muscous membrane both in men and beasts to helpe the lifting vp of the *Epiglottis*, which Fibres are compassed with a little skin both outward and aboue, least it should be hurt in the passage of the meate.

The

The Inner
coate.

The internall Coate or Membrane which is more crasse in the cavity of the Larynx or Throtle then it is in the pipe of the artery, is soft, stretched and slippery, because the cavity was to be made polished and smooth; but where the cleft of the Larynx doth close, this membrane on both sides is by often compressing of it when we hold our breath, made more hard and callous, & with the substance doth change the colour and waxeth more white. But of this Membrane wee haue spoken somewhat before in our History of the Rough Artery. Concerning the vessels also and the Glandules of the Larynx wee shall speake in their proper places.

CHAP. XXXVIII.

Of the Sound and the Voyce.

IT is sufficiently manifest by that which we haue sayd, that the voyce is an action of the Larynx, and that it is the Instrument of the voyce, and that the *glottis* or whistle is the first and immediate cause of the voyce; and this is *Galen's* opinion, wherefore we will discourse a litle of the voyce.

How a voice
is made.

The voyce therefore according to *Aristotle* is a certaine significative sound of a liuing creature, or as *Galen* defines it, the voyce is the aire stricken, and a sound is the percussion of one body against another in some other. There be therefore 3. things required to the effecting of a sound, to wit, two seuerall bodies which do mutually strike one another, and the ayre in which the percussion is made, which ayre is beaten and broken betwixt the two bodies.

What things
are required to
e sound.
The bodies
must be hard.

But that these bodies thus mutually knocking one another, may effect a sound, first, it is required that they be stretched, by which tension or stretching they are somewhat hardened, therefore *Aristotle* supposed that they ought to be hard, for a sponge and wool may mutually strike one another and yet no sound be made. But if you say that sounds are oftener made by hard bodies, yet it is true also that sometimes they are made by soft bodies, for if you ioyne your lips together a kind of whistling may be heard, but this proceedeth from their tension whereby they thrust out the ayre by compressing each other.

Broad and
plaine.
And polished
for the better
sound.

Moreouer they ought to haue a broad and plaine superficies, for two needles striking one another do make no sound. Again, the percussion ought to be vehement and quicke, for if you gently put your hand to any thing no sound is heard. But if besides, these bodies be polished and concauous or hollow, and of a solid and ayry matter, such as brasse and glasse is, then the sound will be greater, more plaine and delightfome, which may be shewed in bells and musicall Instruments, for such bodies containe a great deale of ayre in them, which aer when it is moued and seeketh a vent, doth euery way strike about the sides & euery way causeth a resonance or resounding.

What is requi-
red to a voyce.

Now seeing a voyce is the sound of a liuing creature, or a certaine species or kind of sound; there must be euen so many things required to it as to a sound, Namely the aire for the matter, the bodies which by compressing the ayre doe as it were breake it for the efficient cause; and we may adde the place which is the head of the rough artery.

The aire expi-
red:

The ayre which is required for the forming of a voyce is that which we returne by expiration, and this is the matter for the generating of a voyce; for that which is inspired is prepared for the refreshing and nourishment of the heart and Inbred heate. Wherefore a mans voyce is so long continued as the expiration endureth, and when it fayleth the voyce vterly ceaseth. Now this expired ayre is broken by the ayry Instrument and so the voyce is formed at this breaking, and where it is broken there percussion doth forthwith follow. But it may be demanded which of the ayry Instruments can strike and presse this ayre.

By which of
the spirituall
Instruments
the ayre is
broken.

The chest and the lungs do not make this voyce, because their motions be *Diastole* and *Systole* or dilatation and constriction which make no voyce. Neyther is it the pipe of the Rough artery or the greatest part of the weazon, because it wanteth muscles: wherefore it cannot perfect the voyce which is a voluntary worke.

It is broken by
the throtle and
why.

Moreouer, if you cut the weazon below the larynx or head, the creature wil yet expire freely, but he will not vter any voyce: and if againe you bind this incision the voyce will returne. Neyther is it the Nosthrils which is the cause of the voyce, because they are only passage, nor the mouth because it is onely a receptacle, nor the tong because they which be dumbe haue their tongs & respiration sound; so they which haue their tong cut out do yet vter some kind of

of voyce. It remaineth therefore that amongst the ayry instruments only the Larinx or throtle is it which is, as it were, the shop or worke-houle wherein the percussion is made, which the fabricke and structure of it do sufficiently shew.

For it hath muscles which are necessarily required to the effecting of a voyce which is a voluntary action: It hath also nerues which afford the motion, gristles also which are hard bodies, broad smooth, polished and concauous or hollow, vpon which the aire may easily bee broken, constringed and compressed and therewithall rebound. It hath also a cleft which is requisite vnto the breaking of the aire that so a sound may be made. For this breaking of the aire cannot be done vnlesse it passe through by some straight and narrow way.

This Elision or breaking is made through the cleft when it is constringed and angustated or straightned by the articulation of the *Arytenoides* or Ewre-gristle and the muscles. Wherefore *Galen* writeth that a voyce canot be made vnles the passage be strait, neyther can that passage be wel called straight, vnlesse it tendeth by litle & litle from a large passage vnto a straighter and is againe amplified or enlarged from that straightnes. After this breaking doth a percussion presently follow, cyther against the ayre or against a solid body, and therefore *Galen* supposeth that the *Vuula* is like the quill of a Cittern in the forming of the voyce, because the aer being blown out is forced against the *Vuula*.

How this ayre is broken.

But not onely the straitnesse of the cleft is necessary vnto the voyce that the passage of the ayre be narrow, but also the vehement impulsion of the breath, so that it suddainly and at once breake forth: for when eyther of these faile the voyce cannot bee made; which sudden and vehement expiration *Galen* calleth *expiratio* or efflation. The other cause therefore of the voice is efflation without which it cannot bee made, though there may be efflation without any voyce.

Vehement impulsion of the ayre is required vnto the sound

This exsufflation or strong breathing out is made by the muscles, binding the Chest and the *Abdomen* or panch, by which constriction the Lungs are depressed and constringed, the *Midriff* is incurued towards the cavity of the chest, whereby his cavity is made straiter and the breath carried vpward out of the Lungs thorough the rough artery, (wherefore *Galen* said, that the voice was prepared in the rough artery when the aire being shut vp and compressed there, doth after a sort attaine the state and condition of a solid body before it issue through the cleft) and being extruded or thrust out with violence and force through the strait cleft, yeeldeth that sound which we call a Voyce.

How exsufflation is made.

Galen expresseth the vse of the voyce in these words, that it is the Messenger of the thought of the minde, and therefore worthily is accounted the principall of all the actions of the Soule.

The vse of the voyce.

And thus are wee arriued at the end of this Booke of the Senses wherein wee haue omitted the Sense of Touching because it is already handled in the second Booke. Now wee come vnto the Controuerfies.



A Dilucidation or Exposition of the Controuersies belonging to the Senses and their Instruments, as also of the voyce.

*Iulius Casserius Placentinus his Præface, translated by a
Gentleman, who desired it might bee keere
inserted.*

Of the Excellency of the Senses.



The contem-
plation of our
felues doth
further vs in
the knowledg
of God.

When I compare Diuine things with Humane and in like maner Humane with Diuine, and with a through examination doe diligently view the properties of them both; I can finde no man so neere a kin to the Nature of God, as those which make good vse of that Oracle of *Apello*, *γνῶθι σεαυτόν*, *Know thy Selfe*. For seeing that admirable Archite& maker of all things did make man according to his owne Image, it cannot be but he which is well skilled in the Fabricke and Workman-shippe of himselfe, vnto him I say will the Nature of the Creator and Arche-type more plainly appere, because hee which is well read in his owne body, shall see in all euen the least operations of his minde or actions of his body a liuely impressiō and infallible markes of Diuinity. And hence it was that they which vsed no diligence to pry into the structure of their owne bodies, were worthily reproached by the Ancient with the ignominious Tittle of *Epicurean Hogges*, for such men being ensnared with the allurements of their Senses, were onely carried thither, whither like Beastes they were transported by the force and rage of their senses, measuring the chiefe felicity of man by the narrow scantling and naked pleasure of the body. But *Ouid* doth manifestly shew how farre a man differs from a Beast where hee singeth,

*Pronaque cum spectent animalia cætera terram,
Os Homini sublimè dedit, calumque tueri
Iussit, & erectos ad sidera tollere vultus.*

When other creatures on the earth do pore,
Nature gaue man a high erected looke:
The Heauens to view, and Dicties to adore,
And read the Characters in that faire Booke.

Why beafts
looke downe
and men vp-
ward:

Surely a hidden mystery of a Poet, and words truly befeeming a man, wherein he would intimate nothing but this, that man being mindfull of his Diuine originall, may by the contem- plation of himselfe ascend higher into the mysticall knowledge of his Diuine Creator. Seeing therefore it is a matter of so great moment to know our felues: It seemeth to mee not onely commodious, but of absolute necessity to compose some smal Treatise (though a taske of hard labour) wherein as in a most cleare glasse a man may take view of himselfe, and see his owne nature as it were deciphered with *Apelles* Pencill. Wherefore I will here exhibite both the essentiall parts of man, to wit, his Matter and Forme, together with their functions and pro- prieties, as well particular as common, obseruing the order of Nature, because wee cannot come perfectly vnto the knowledge of man, vnlesse first wee doe well see into the Essence both of the body and the soule. Now the knowledge of the soule cannot bee made manifest but onely by her operations, which also seeing she doth not performe without the helpe of corporall organs, there is a necessity imposed, that we also vnderstand the exact composition of the body. But because in the deliery of the method of Arts we ought alwayes to proceed from vniuersals and such as are better knowne vnto vs, vnto particulars, and that the faculty of sensation is as it were an vniuersall thing, as being disperfed through the whole Systeme and frame of the body, the order of Nature requireth that I treat of it in the first place.

Why he first
treateth of the
Senses:

More-

Moreouer, amongst all the offices of the Soule, this facultie of sensation seemeth to challenge the chiefe place; neither that facultie onely which is lodged within and receiue the Images of things, and after deliberation or discourse doth iudge of them; but much more that whole set of Sences which doe outwardly *perceiue* all sensible objects, and perceived, doe carrie them to the Tribunall of the internall Sense and doe so informe it, that it is able to pronounce a true iudgement concerning them. For without these externall Sences, we must needs acknowledge the Internall imperfect and vnprofitable. For if we conceiue any thing in our minds and nourish that conceit by discourse, againe and againe ventilating it to and fro, we shall obserue that all things had their originall from the outward Sences; for neither could Colours, Odours, nor Sauours be knowne, neither could the internall Sense discourse of Sounds, or of any Tactile qualities without the message (as it were) and information of the outward Sences, by which the Images of things are imprinted in it. And with this doth that Philosophicall Axiome agree. *Nihil est in intellectu quod non prius fuerit in sensu. Nothing is in the Understanding which was not before in the Sense.* The Prince of Philosophers esteemeth this the Fountaine of all Arts and Sciences. And surely if any Man setting aside the assurance and the authoritie of Senses, shall seeke for the grounds and *endences* of Arts and other Objects else-where, he shall not onely entertaine into his mind a dissolute and vaine confusion, tossed hither and thither without any stedfastnesse, but also calling in question the most sure Foundations of Nature, shall cast himselfe headlong into a Dungeon of perpetuall and intricate obscuritie.

All Arts haue
their beginning
from Sense.

*Quid referemus enim quod nobis certius ipsis
Sensibus esse potest; quo vera & falsa notamus?*

For what more certaine evidence of things can be obtained,
Then that which true or false we iudge by outward Sense vnsained?

Whence shall he haue the grounds of Demonstration which endeauoureth to derogate from the credit which is due vnto the Senses, which are the Foundations of all Sciences? For Demonstration is from vniuersall things, and such vniuersals doe arise and spring out of singulars: But the externall Senses doe *perceiue* all singular things. Now there is none so ignorant who doth not see what will follow hence. The same thing *Lucretius* confirms in these Verses.

Demonstra-
tion from
Sense

*Iunenes primis a sensibus esse creatam
Notitiam veri, nec sensus posse refelli,
Qui nisi sunt veri, ratio quoque falsa sit omnis.*

The knowledge of all truth (who seekes) must hold
From outward Sences first to haue proceeded
Those Demonstrations cannot be controld,
Or could they, Reason's selfe should be deceived.

Hence it is, saith *Aristotle*, that such Men are vnfit for some Arts and Sciences, to whom Nature hath from their birth denied any of these Senses.

Whosoever therefore doth not content himselfe with the infallible credit of the Senses, is worthy with *Anaxagoras* (who called into question the whiteneffe of the Snow, as *Aristotle* remembreth of him) to be giuen ouer vnto the doubtfull and suspended vncertaintie of the *Pirrhonij* or Sceptickes; and to wait till the things themselves should tell him what their seuerall natures are. But we in the meane time admiring this maiestie and certaintie of the Senses, will make entrance into so faire and pleasant a Field of Discourse, and handle euerie one of them in particular, beginning with the Sense of Touching, which as it is more common then the rest, so without doubt it deserues the first place: For this is the ground of all the rest, and doth consist in the *εὐπαρέα*, or moderation and temperament of the foure Primarie qualities. And hence it was that *Aristotle* (and with him all other Philosophers) haue iudged this Sense worthy that honour to be called *κατ' ἐξ ἑνός*, or by a certaine eminency or excellency without adding thereto any Epithite, *The Sense*; as if they should haue said, the onely Sense of all Senses. And that not vnworthily; seeing (as the same *Aristotle* affirmeth) euerie Sense is a kind of Touching, as whereof the whole company and set of the other Senses doe stand in need for the better perception of their objects. As for example: The Taste neuer should discerne of saviours except the Gustible matter were touched by the spongy body or Pulpe of the Tongue: Neither could the Organ of Smelling receiue any

The dignitie
of the Sense
of Touching

No Sense
without
Touching

Odours vnlesse the perfume of odoriferous things should touch the same. The same are we to thinke of the other Senses, to which in like manner is required, though not a Mathematicall yet a Physicall Touching: What need we add more? It is the Sense of Touching, which perfecteth the operations of all the other Senses, and yet it selfe needeth not the helpe of any. Yet this I add moreouer, that this Sense is capable of the nature of many more contraries then the other Senses, for it iudgeth of heat and cold, moyst and dry, soft and hard, light and heauy, slender and grosse, rare and dense, smoothe and rough, and an infinite number of that kind. On the contrarie, the Sight doth perceiue nothing but white and blacke; for red, yellow, sky-coloured, and other such like, are not contrarie but intermediate colours, and so of the rest. I may also lightly passe by this, that all other Senses are restrayned within some small Organ about the Braine, but the Touching is diffused through the whole Body.

Conception
is by Touch

These Arguments doe sufficiently commend the preheminance of this Sense of Touching. Yet if you please to attend, and more accurately consider those which follow, you shall see the maiestie thereof to shine more plainly vnto you. For first, it is by the benefit of Touching that we are conceiued and formed in the fertile Garden of our Mothers Wombe. For wise and prouident Nature ayming at Eternitie, hath endued the parts of Generation with a most exquisite Sense of Touching, for the conseruation of the Species or kinds of Creatures, so that the Creatures being rauished with an incredible kind of pleasure, doe more readily apply themselves to Venereall embracements (otherwise a thing rather irksome then to be desired) and endeaour the procreation of their owne kinds. When the Infant in the Wombe yet liueth onely a vegetatiue life, he is first of all endued with the Sense of Touching; whereby he is cherished, nourished, encreased, and at length perfected; for so long as he is in the Prison of the Wombe, he neither seeth, nor heareth, nor smelleth, nor tasteth any thing, but yet hath absolute necessitie of the Sense of Touching, that he may be able to auoid imminent dangers.

The Touch
doth first
exist of all
Senses

Moreouer, this Sense is not onely borne together with vs, but also (which is more worthy of admiration) when all the other Senses perish, or are suspended vpon small perturbations of the Mind, and leaue vs vngarded and prostituted vnto Death; yet this, like vnseparable and faithfull *Achates*, doth attend vs vnto the last breath: whence *Aristotle* in the third Book *De Anima*, Cap. 13. Text. 67. writeth, *That if any Creature be deprived of this Sense of Touching Death will of necessitie ensue. For neither is it possible (saith he) that any Creature should want this Sense, neither to the being of a Creature is it of absolute necessitie that he haue any Sense besides this*; As if he should say, that this Sense is of the verie Essence of the Creature; and therefore other sensible objects by their immoderate extreames, doe onely corrupt their proper Organ, but the excessiue qualities of tactile things doe take away the life it selfe. Againe, things euen without life cannot subsist without Touching, as *Aristotle* saith, who thought that neither action, nor passion, nor any mixtion can be without Touch, & therefore neither can the *mixt body* be without it. For though those things without life doe draw their nourishment out of the Earth, yet they doe it not indifferently and without choyce of that which is more or lesse pleasant vnto them, if at least this kind of naturall accord may be called a pleasure, which is nothing else but a power to separate or distinguish that which is conuenient, from that which is inconuenient.

Touch is of
necessitie,
the rest for
commoditie

Plants cannot
be without
Touch

Furthermore, if we will stand to *Aristotles* determination, that there can no other Sense subsist without Touching, then will it follow that this being taken away, no Sense can remaine. Now if the Senses be taken away, the whole Family of Arts (which we said before did depend vpon their credit) must needs decay, nay you shall remoue the Sunne it selfe out of the World. If any Man doubt of this, let him seriously suruey all the Arts both Liberall and Mechanicall.

The vse of
Touching for
Physicke

If you further demand what vse this Sense doth afford vnto Physicke, know that without it this Art would be verie defectiue, yea would so darken the Eyes of Physitians, that they shall not be able to determine any thing certainly concerning the temperature of their Patients, or of their Faculties or strength; but must of necessitie grope vncertainly in darke and palpable ignorance.

His profit in
morall Phi-
losophy

If you respect Morall Philosophy, this Sense will stand vs in great stead. For perceiuing and feeling the euils which ensue of Vices it doth lead and encline vs vnto the way of Vertue; yea it causeth vs to take pleasure therein, which pleasure the Epicures doubted not to account the *Summum Bonum*. The like we might say of other Arts, which (least our

Discourse

Discourse should be without end) we will with silence passe by, in all which Touching is not without his excellent vse.

To conclude, If it be lawfull to transcend from these Earthly things vnto Celestiall, we will a little consider what vse this Touching hath in Diuinitie. Did not this Sense reduce *S^t Thomas* wandring in by-ways out of the heavenly light into the true way, when he would try the presence of our Sauour by this Sense as it were contemning the vse of the rest? Did not the Woman onely by the Touch of the Hem of Christs Garment become sound and cured of her twelue yeeres Flux of Blood? And doe not we read that eternall Prince of Physitians restored sight vnto the Blind onely by the Touch of their Eyes? And did he not heale the Woman sicke of a Feauer by Touching of her? Yea, and that which is beyond all admiration and farre exceedeth the vnderstanding & capacitie of Man, did he not bring againe from Death vnto Life the Daughter of *Jairus* by taking her by the Hand? And the Sonne of the Widdow ready to be committed to the Earth onely by Touching the Coffin? O healthfull and sauing Touch! O searching Sense! But we hold our Hands, both Time and the Matter requires that we prosecute the remaining Senses in as few words as we can.

After the Sense of Touching we place the Taft in the second ranke. For besides that one kind of Obiect, to wit, Earthy, is by Philolophers assigned as common to them both, it is as well as the Touch not onely commodious (for so are the other subsequent Senses) but also necessarie vnto the conseruation of the *Individuum*, whence it is that many commendations of the Touch doe not vnfitly agree vnto the Taft. For seeing Taft is the chiefe Sense in discerning of Savors (as all Men of vnderstanding acknowledge and experience it selfe confirmeth) it must needs follow that by the helpe thereof the Body is nourished without danger, but when it failes the Body perisheth & the whole nature thereof goeth to nothing. For without it we cannot discerne of Savors, nor iudge betwixt hurtfull things & healthfull, neither betweene that which is pleasant and vnpleasant, but become inferiour not only to brute Beasts, but also to Plants, which doe not confusedly and without choyce, attract any Aliment but that which is most agreeable to their Nature, and so conuert it into their owne Substance.

But because the Sense of Tasting doth participate with the Touch in the perception of sweetnesse & pleasantnesse as in many other things it doth: Therefore I suppose the worth or excellency thereof is sufficiently declared in the commendation of the Sense of Touching, so that we thinke it vnnesse to vse any longer discourse thereof.

We will now proceed to the Sense of Smelling, the Organ whereof seeing Nature hath placed in the middle of the other Senses, we will therefore ascribe vnto it the middle place of honour between the other Senses. This Sense doth not onely receiue the fragrant breath vapouring from odoriferous Obiects, and abiding in the Aire; but is besides a faithfull Taster of Meats, it gouernes the Mouth least some-times at vnawares we should swallow that which is hurtfull and distasting, and so pollute the sweet Balsame of our Life. And this instinct we see in Dogges and Apes, who neuer snatch any thing into their Mouthes before they haue first made tryall thereof with their Nose.

Againe, by the strength of this Sense many Creatures doe hunt out their liuing, and therefore the Kites follow after Karkasses, Hounds after Hares onely by their sauers: I say nothing of that profit which it affords to the Art of Physicke: For among other predictions in our Art, that is not the least which is taken from the Sauour of the Patients Sweat and other Excrements, whereby oftentimes we find out the cause, the kind, and the issue of the Disease. Chirurgians also by the Sauour or Smell of a Wound are able to iudge whether it be *Cacoeticum*, that is, of an ill and vntoward disposition or no. Add hereto that by the Smell we attaine to the knowledge of Simples, yea and of Compositions, with what faculties and vertues they are endowed. From hence some haue concluded that all odoriferous things are hot, and such like Propositions and Paradoxes.

The beautie that is added to the Face of Man by this Organ of Smelling (we meane the Nose) is verie great: I will giue you a pregnant instance thereof in an example or two worth our remembrance. First, of a young Man who being adiudged to be hanged, and the Executioner at hand, a certaine Mayd suborned by his Friends, and quaintly dressed and set out, goes vnto the Iudges and makes supplication for his life, requiring him for her Husband; well, she ouercame the Iudges: This done, the guiltie young Man being set at libertie and comming from the Gallowes vnto the Mayd attired and dressed in costly Ornaments,

The profit of
touching in
Diuinitie.

Luke 17

Luke 18

Math. 9

Luke 7

The prayse of
tasting.

It is necessary
for the conser-
uation of the
Individuum.

The prayse of
Smelling.

The Nose
doth much
beautifie the
Face.

he presently cast his Eye vpon her Nose which indeed was verie deformed, and instantly cryes out, That he had rather haue beene hanged then freed vpon condition of vndergoing so deformed a choyce in his Matrimony. To this is that of *Horace* verie answerable in *Arte Poetica*.

Hunc ego me, siquid componere curem,

Non magis esse velim, quam prauo vivere Naso:

Should I indite, I had as lief my Nose should stand awry,
As fairely to begin my worke, and patch't vp bunglerly.

A Historic.

It is also a very memorable example (for we may mingle things thus holy with profane) which we read in our English Chronicles concerning one *Ebba* an Abbess in a certaine Nunry, who cut off her owne Nose and the Noses of her Nunnes, that being so deformed they might auoyd the hatefull lust of the *Danes*; taking it for granted, that the Nose was the chiefe ornament of the Face. And hence it was that in ancient time, when they would put Men to great disgrace and ignominie, or disappoint them of all hope of attaining to any degree of honour, or the gouernment of a State; they cut off their Eares and Noses. Yea those which had such deformed Noses were neither admitted to any Priestly function nor Imperiall Office. So farre was it from them to account them worthy honour, who were destitute of this honourable Organ. Hence it was that the Prince of Poets, *Virgil*, in the sixth of his *Aeneids*, doth call the cutting off *Deiphobus* his Nose, *Vulnus in honestum*, a wound full of shame and reproach. To these we may add, that the Nose is necessarie for our verie life, because Nature hath made it the Instrument of Respiration, without which we cannot liue one moment; for when the Lungs needs more Aire then ordinarie, we perceiue the sides of the Nose-thrills to be moued, some-times not without violence.

The Nose is
necessarie to
life.

The wonder-
full frame of
the Eare.

But passing by a whole troope of these commendations of the Sense of Smelling, we will proceed vnto the Hearing, which no Voyce, no not a Riuer of Eloquence is able to extoll with due prayes, if we doe but contemplate the cunning, skill and diligence, which Nature hath vsed in the Fabricke of this Organ, and more accurately intend how many winding Conuolutions, Burrowes, Holes, Shells, Dennes, and darke Caues like Labyrinthes she hath prepared and furnished therein.

Hearing is the
gate of the
Mind.

I add further, that by the benefit of the Eare we attaine vnto the knowledge of all kinds of Sciences: In respect of which, *Tully* doth equallize vs with the Gods. For these Arts are not ingrafted in vs by Nature, but to be obtained otherwise; for saith *Lactantius*, it is the propertie of God and not of Man to haue *proper knowledge*, that is, arising out of himselfe. For this cause Nature hath by a diuine Skill, made the Eares open, that we might alwayes heare when learned Men should teach and discourse learnedly, and lay vp in the Register of our Minds that which we haue heard. And hence it was that *Constantine* called Hearing the *Doore of the Mind*, because hereby we enter into the knowledge of other Mens conceits, and whatsoever is concluded within their Braynes, as it were, vnlocked and layd open by this Sense of Hearing vnto others. But some will haply say, that we may attaine vnto knowledge by Reading without any helpe of Hearing. We answer, that no Man knowes how to read which hath not first learned it by the meanes of Hearing. I will omit that which is found by experience, that a liuing and audible voyce doth better instruct then the silent reading of Bookes, and that things heard make a deeper impression in the Mind then those which be onely read, and hence haply was *Pliny* brought to beleue the Memory had his place in the lowest part of the Eare. Others there are who doe call Hearing the Sense of Memory, whence in their *Hieroglyphickes* they were wont to decipher and paint Memory a Hand holding an Eare; I also passe this by, that Hearing is after a sort the spy of the Life and Manners, whereupon *Isocrates* desirous to try the towardnesse of a young Man whom he saw: *Speake* (saith he) *that I may see you*. And in holy VVrit, *Iob* commands that *they bend their Eares and see*: accounting for certaine, that Hearing is the very meanes of discerning and iudging of Mens minds.

Hearing is the
Sense of Me-
morie.

The prayse of
Sight.

But the desire I haue of breuitie commands me to abridge my discourse. There remains now of the externall Senses onely Sight, which if it be not superiour and aboue the precedent Senses in dignitie and honour, yet it is not a whit inferiour to any of them. I say in dignitie not in necessitie: For if thereby we esteeme their Prerogatiue, Sight must come behind: But if you respect the situation, the conformation and the vse of this Organ, you may pronounce it more worthy by many degrees then any of the other.

For

For the situation and place, it is in the most erected Region of the Head: Beside proud Nature, hath on euerie side bounded the Eyes with a concauous Valley. They haue a sphericall or round figure, which is no small argument of their excellencie, seeing Nature is neuer wont to vse this noble figure, but when she endeauours to effect some difficult or excellent worke. And for their vse we may thence easily inferre their preheminance, for beside that they watch for the safetie of the Creature, detecting things hurtfull, manifesting things profitable, and laying open the differences of all things which are contained in this large Vniuerse; they bring vs vnto the knowledge of all things, so that they alone are fit and sufficient for inuention and discouerie of Arts, and (which is the most of all) they doe make manifest the great Creator of all things by those things which are visible, in the knowledge of whom doth our chiefest happinesse consist. They therefore which be destitute of these most diuine Organs, may truly professe themselues miserable, seeing they remaining in perpetuall darkenesse, cannot admire and contemplate the workes of Almighty God, nor behold the infinite varietie of the kinds of things, neither yet dare euer affirme that they know any thing certainly, because of force they must beleue that which they Heare related to them by others.

That spirituell and most noble object of the Eye (I meane the Light which is the Queene of all qualities) who doth not admire? And hence also concludes the supremacie of this Sense; for the Eyes by the fruition of Light doe distinguish Life from Death. Doth not Hippocrates (the Pillar of Physicke) propound vnto vs most certaine signes of the passions of the Mind by the Eyes? By these as by Windowes we may pry into and penetrate the deepest & most secret conueyances of the Soule; and therefore Alexander not vnadvisedly said, that the Eyes were the *Looking-glasse of the Soule*, whereupon some famous Philosophers haue placed the chiefe seat of the Soule in the Eyes: For the Eyes doe burne and shine, they twinkle, they winke, they are sorrowfull, they laugh, they admire, they loue, they lust, they flatter, and in one word they decipher and paint the Image of the Mind with so artificiall a Pencill, that they seeme to be a second Soule; what shall we say more? Doth not Galen himselve so highly extoll this Organ, that he thought the Braine was onely framed for their sake, a part so necessarie and excellent, that it makes vs very much resemble the very diuine Nature? And doth he not moreouer write, that the whole Head had the highest place in the Body, onely because of the Eyes?

A commendation doubtlesse wonderfull, yet not more admirable then competent and worthily deserued. For being a Man of great and profound knowledge, he considered that the Eye was the true *Microcosme* or *Little world* in respect of their exact roundnesse and reuolutions: wherein besides the Membranes, which I dare boldly call the seuen Spheres of Heauen, there be also the foure Elements found.

That Fire is there, we will proue in a conuenient time and place. That there is Aire, who will deny which vnderstands with what plentie of Spirits they doe abound? As for Water who doth not see it in the Eye doth proue himselve more blind then a Beetle. All the other parts we will liken to the Earth.

If you looke vpon the *Pupilla* or Apple, shall not you see shining Starres, yea rather a beaming Sunne? Wherefore thou maist not vnsightly call the Eyes with the Poet, *τῶν ἡλίου πυλᾶς* *The Gates of the Sunne*. Shall you not perceiue here the diuers-coloured Raine-bow, framed with a seuen-fold Circle? Shall ye not also obserue Hayle and infinite other things, which doe most fully declare the excellencie of this Sense by themselues without any additament of our Oration.

But seeing, as Agellius saith, It is more blame-worthy to prayse a thing slightly and coldly, then earnestly to dispraise it, least we should seeme to preiudice the worth of so excellent workes of Nature, we will here make stay and addresse the small portion of our capacities vnto a more abstruse Contemplation concerning the Nature, Manner, Number, Order, Medium, Object, and Organs of all the Senses in Generall: afterwards we will descend vnto particulars.

From their place.
Figure.

And vse

The miserable condition of the blind

The object of the Eye most noble

The Braine was made for the Eyes

That it is a Little World

The foure Elements in the Eye

The Apple and Raine bow of the Eye

Agellius

QUEST. I.

What Sense is.

The definition
of Sense by
Aristotle.

I. Grammatic.

Al. Aphrod.

Simplicius
definitionAll Sense is
made with the
knowledge of
the object

¶ Auing by way of Preface set forth the excellencie of the Senses, we are to proceed vnto a more full Discourse of them, which that we may the better accomplish, before we assay their particular handling, we will take a Taste of them in generall, which may make way to the particulars, and may serue in stead of a Preamble, for the Readers better vnderstanding. First of all therefore, it is to be considered what *Sense* is. Aristotle in the second Booke *De Anima*, Text 12, saith, *That Sense is that which can receiue sensible Formes without any Matter*. But he seemeth to define Sense in *potentia* only or *power*, which haply he would insinuate by the word *potest* or *can*, especially, because this cannot be a true definition of *Sense* as it doth indeed and really *perceiue*; for a Glasse also doth receiue sensible formes without any materiall substance, and yet that perception is no Sense. Whence Ioh. Grammaticus vpon the 127 Text of the second Booke *De Anima*, saith, *To be able to perceiue is not onely to receiue Species or Formes without the Matter, but there is also requisite an Animall Facultie which is not in all things that receiue the Formes of sensible things without the Matter*; as if he had said, Euen as it is in Glasses.

But the Philosopher would shew what manner of perception was necessarie to Sense, that is to say, that it haue the act of perception; and how the object ought to be disposed; except by the word *perceiue* he vnderstood *discerning*, which words Philosophers doe sometimes promiscuously vse, as we may gather out of Alexander Aphrodisias, who vpon the third Booke of the Metaphysickes saith, *That Sense is an apprehension or discerning of present sensible things which are without the Sensorium or Organ*, and this is Sense in deed and act; for we are then said to *perceiue* when we discern the object, which Simplicius vpon the 155 Text of the third Booke *De Anima* hath well noted, defining Sense to be *A knowledge or discerning stirred up in the Organ, first receiuing his act from the sensible object*: So that Aristotle by receiuing vnderstood nothing but the knowledge or discerning of the Object. And the same definition he doth accurately and distinctly declare in the second Chapter and 138 Text of the third Booke *De Anima*, where he saith, *That the Instrument of euery Sense doth receiue the sensible object without any matter, and therefore the objects being remoued, there are in the Instruments of the Senses, Sensations and Imaginations*. What can be more euident? For how can the Sense of that Object remaine in the Organ when the Object is set aside, if it should onely receiue it without any act of discerning? Are we not taught the contrarie in Glasses, which because they onely receiue, but know or discern nothing, therefore presently as the Object is remoued, they loose the Image. We will therefore out of this which hath bene said, gather a most cleere and absolute definition of Sense on this manner, *That Sense is a knowledge or discerning of the Object receiued formally in the Organ*.

QUEST. II.

What Action is, and how Action and Vse doe differ.

What Action
isWhy action is
called an
Active motion

¶ Verroes verie worthily saith in the first Booke *De Anima*, and the 51 Text, that the first and chiefe consideration of Sense is, *whether it be to be accounted amongst the Active or Passive Vertues or Faculties of the Soule*, that is, *Whether it be accomplished by Action or Passion*, for he which is ignorant of this, can neuer attaine to the perfect knowledge of the manner of Sensation. Considering therefore of this matter by the counsell of Auerrhoes, I haue here determined for the more euident clearing of this Question, to declare what Action is, and also what Passion is.

Action therefore (which the Greekes call *ἐνέργεια*) is a certaine active motion, proceeding from any thing fit for action for the obtaining of some thing. It is called an *Active motion* by Galen in the first Chapter of his 17 Booke *De Vsu Partium*, and in many other places, and that not without good reason, seeing that there is as well an Active motion as a Passive motion. Many call that an Active motion which is performed by the proper nature of the thing, and of it selfe alone: And that Passive which is caused by some externall Agent. As for example: The

The walking of a Creature is an Actiue motion, in regard that it proceedeth from the proper and internall Facultie of the Creature. But the casting of a Stone vpward is a Passiue motion, because it is performed by another, and not by the proper internall principle. But because all motion made either by an internall or externall Agent, in relation to the Patient is Passiue, and in relation to the Agent cause is Actiue, therefore certainly the casting of a Stone ought no lesse to be iudged an Actiue motion, then the walking of a Creature, neither doth this deserue lesse the name of a Passiue motion, then that; for a Creature in walking doth suffer, else we must determine (which is more absurd) that there may be an Action without Passion.

What actiue -
internall mo-
tion is

But in my opinion the Logicians distinguishing Actiue motion from Passiue onely in some respects and not in deed, haue more truly said, that Actiue motion is that which proceedeth from the Agent for the effecting of some thing; and Passiue that which is receiued of the Patient to make alteration in it: wherefore both Action & Passion being in deed one motion, as it commeth from the Agent is an Action, and as it is receiued of the Patient is a Passion.

What W
not to be

What W
not to be

Action is
relative

How action
and passion
doe differ

It is added in the aboue-named definition, *from any thing fit to performe Action*, because euerie thing doth not produce an Action, but that which hath a disposition and fittest for the performance of that Action. This fittest or habitude vnto Action, called in Greeke *εὐχρησία* or an agilitie of vsing, *Galen* in the first Chapter of his 17 Booke *De Vsu Partium*, calleth *Vse*, which signification doth much differ from the word *Vse* taken for the act of vsing or for the handling & exercising of an Action, whereof *Cicero* speaketh in his *Topicks*. For *Galen* vnderstandeth by *Vse* an aptitude and disposition of the parts to performe an Action, which parts if they were composed by Nature without this fittest they could neuer performe any Action, and so they should haue beene made in vaine.

Divers accep-
tions of vse

This fittest in liuing Creatures consisteth in the Temperature of the Similar parts, and the Legitimate conformation of the Dissimilar, which doth comprehend the Figure, Magnitude, Site and Number of them. Therefore this due Temperament and Conformation, as it is fit for operation is vnderstood by the word *Vse*.

Wherein this
vse consisteth

Moreouer, this *Vse* is two-fold, Principall and Assistant. I call that Principall, by the help whereof the Agent doth principally performe and exercise his operation. The Assistant I call that which is as a Handmayd, to helpe and further that the Function be the better performed. Againe, this Principall is also two-fold. Not subordinate and subordinate. The Assisting *vse* is three-fold, First, that which doth truly helpe; that which doth conferue or keepe; and thirdly, that which addeth some ornament or beautie to the Action.

Vse is twofold

That which is *not subordinate*, doth accomplish a principall Action which is not inferiour to any other: But that is subordinate, for whose sake the Agent vndertakes an Action which is subordinate and preparatiue onely. That *Vse* or aptitude which doth onely helpe and conferue, may be seene in the Lids and Hayres of the Eyes. And *Galen* in the 13 Chapter of the 11 Booke *De Vsu Partium*, doth plainly affirme, that the ornament and beautie of the Action is to be referred vnto this helping or assisting Aptitude.

The vse not
subordinate.
The vse sub-
ordinate

But here ariseth a difficultie, which is not slightly to be ouer-passed; for if those things be true which we haue said as we professe them to be, it will necessarily follow that in liuing Creatures euerie Organ shall haue some *Vse*, in as much as there is no part in the Whole liuing Body which is not fit and disposed to operation after some of the fore-said wayes, as is taught in the first Chapter of the 17 Booke *De Vsu Partium*. But *Galen* seemeth to differ from himselfe and to contradict this Doctrine in the eighth Chapter of his Booke *De Morb. Diff.* where he saith, that some parts haue *Vse* onely and not Action: Some haue both *Vse* and Action: And others haue Action onely and not *Vse*.

Obiection.

But this knot may thus be vnloosed, and this contradiction reconciled, if we say, that to haue Action and *Vse* is affirmed as well of that which doth helpe, as of that which doth principally apply it selfe to the performance of the Action: So euerie part of the Body shall haue both Action and *Vse*; but so, as to *haue action* doth signifie that aptitude by which the Action is especially performed, and to *haue vse* that for whose sake, or by whose meanes the *Vse* and the Action is holpen and assisted. The Action therefore is principally from the parts, and the *Vse* they haue ouer-plus, that is, that aptitude and disposition whereby the principall Action is either perfected or conferued, or receiueh some additament of beautie and ornament.

Solution.

QUEST. III.

Of the end of Action.

What is the
end of action

The action is
lesse worthy
then his end

THE last part of the definition was, *for the obtaining of something*, that the profit and end of the Action might be intimated, which is the fruition of that where-vnto the Action is directed. This is after the Action in Generation and Constitution, but it is the first in dignitie and excellencie, as *Galen* declareth in the 13 Chapter of the 11 Booke *De Vsu Partium*. And as the fruition of any thing is the profit of the Action, so the Action is the profit of the Vse: So that (as *Galen* saith in the first Chapter of his 17 Booke *De Vsu Partium*) Those things which haue an vse for Action, haue a double profit propounded to themselves, that is, the Action it selfe which is the profit of the Vse, and the fruition which is the profit of the Action.

Question.

Here doth arise a most intricate difficultie to be resolu'd, for because (saith *Galen* in the 8 and 16 Chapters of his first Booke *De Vsu Partium*) There is required vnto the knowledge of the profit of the particulars, a precognition or fore-knowledge of the Action, I thinke we must distinguish betwixt the Action of the parts and the profit of them, and so it is false, that the Action is the profit of the parts or of their aptitude.

Solution.
To know the
action is two
wayes vnder-
stood

The Action of the Organs may be knowne two wayes, either vniuersally and abstracted from their Organ, so that the production of the Action may be made manifest without any consideration of the Organ: or it may be knowne as it hath relation to the Organ, that so it may be manifest by what meanes it proceeded from the Organ, & what euerie part did performe which is found in that Organ. Now *Galen* affirming that the Profit of particular things cannot be vnderstood vnlesse we accurately fore-know the Action, doth vnderstand by the name of Profit the *Action*, and so would signifie, that the particular Action ought to be vniuersally and abstractedly fore-knowne, that it may appeare by what meanes it comes from his Organ, & that the function of euerie particle which is found in that Organ (though neuer so small) may be knowne. And so it is not absurd, that the Action should minister knowledge to it selfe, and should be both more knowne and more obscure then it selfe.

The difference
betwixt vse
and profit

The Vse therefore of the parts and their Profit, doe differ as the words of *cause* and *effect*, though Vse doe also signifie Profit, whereby it is manifest that the one is more large in his signification then the other.

The difference
of a worke
and action

Moreouer, that thing vnto the fruition of which the Action doth aime, is either separated from the Action so that the Action ceasing it is abandoned, or else it doth onely consist and hath his being in *Fieri*, that is, whil' it is in motion, & this is called in Latine *opus*, in Greeke *ἔργον* *actionis*, the worke of the Action. *Galen* therefore in the first Booke *De Nat. Fac.* saith well, that the worke is distinguished from the Action & is an effect thereof as Blood, Flesh, a Nerue, or such like are the effects of the Action of the Liuer and of the Seed.

Sometimes by the name of *worke* we vnderstand the Action, for Concoction, Sanguification and distribution, are certaine *actions* and yet the *workes* of Nature also; but we must beware least we call all the workes of Nature Actions; for Flesh, a Nerue, and Bones are the workes of Nature, and yet no Actions of Nature.

QUEST. IIII.

How manifold Action is.

What is an
vniuersall
action

Alen in the first Chapter of his Booke *De Vtilitate Resp.* deuideth the Action of a liuing Body into an vniuersall and a particular. I call that an vniuersall Action which is perfected by the whole Body as by his proper Instrument, as are the life (which life *Aristotle* in the 10 of his *Ethickes*, Cap. 3. and *Galen* in the place aboue quoted say, is a kind of Action of the Creature) as also are those foure which do attend it:

What a parti-
cular action is

Retention, Concoction, Attraction and Expulsion. Particular Action I call that, which belongeth to some one part or Organ, for the profit and behoofe of the whole Body. But they are almost infinite, yet all allotted to their owne proper parts, & so mutually conioyned and with such concord that they doe all serue and helpe the operations of the whole, and doe all conspire and as it were with one consent suffer together. For great Organs as the Head, the Breast, the *Abdomen* or Panch, and the joints doe with all their functions immediately serue the

The consent
of the parts

the whole Body: and the lesser which are parts of these are also referred to the Action of the whole. As the Eye whose Action being wholly destinated to the safetie of the Creature is Sight, which Nature by the Christaline humor doth exercise; all the other parts of the Eye doe concur vnto the constitution thereof, and serue either as causes without which vision cannot be made as the Opticke Nerues doe; or as a cause of the better performance of this Sense as the Muscles and Coats; or lastly, as conseruing and defending causes, as the Eye-lids and the Eye-browes.

Some doe subdiuide a particular Action into a common or publike, and into a proper or priuate Action; and they call that common which is referred vnto the vse of the whole and not of any priuate part onely, as are those operations called Animall, to wit, going, apprehension, vision, hearing, smelling, tasting, touching, imagination, ratiocination and memorie. Amongst the naturall operations, chylickation or the action of the Stomacke changing the Meat into Chylus, Sanguification, Expulsion of the Excrements, the sucking of the Vrine out of the Veines by the Emulgents, Attraction of Seed, the conformation of the Infant, with many other. They call that a proper Action, which is addicted vnto one only part, such as they affirme to be retention, Concoction, Attraction & expulsion, which I haue comprehended in the number of vniuersall Actions, but they say they belong vnto the proper vse of the part.

What a common action is.

What a proper action is.

But this manner of distinguishing is not to be in euerie respect admitted in my opinion, because it doth much rather engender a confusion then further our vnderstanding, in that they confound a proper and particular action with an vniuersall. For why should that action which pertaines to the whole and is vniuersall and common to all the parts, be called proper and priuate? How shall it be allotted to one onely part? If that which they call common be assigned to one Organ, how is it said to be common? Yet if any Man shall say, that it is called common by accident, because it tends to a publike and common good, him I will not gain-say. But it will be obiected, that that which is called by them a proper & priuate action, will by the Physitians neuer be admitted to be vniuersall and an action of the whole Body, and of all the parts thereof. For although attraction, retention, concoction, expulsion, doe agree to the whole and to all the parts, yet they be so appropriated to their seuerall parts, that they seeme to be proper vnto euerie particular, because the seuerall parts doe conueniently exercise them by their owne nature. But I thinke, that attraction being restrained to some certaine humour, doth not enduce the proprietie of attraction, but of that which is attracted by it.

Obiection.

Solution.

Now that which is drawne, and the attraction it selfe doe differ. So a Bone doth attract, yet not as it is a Bone, but as it doth participate of life and the function of the whole, yet it doth attract a proper iuyce as it is such a part and no other. But be it so, that attraction and other naturall functions doe belong and be ascribed to a Bone, a Gristle, a Membrane, and other such like parts as proper vnto them, in regard that they all doe properly and in their owne nature conueniently exercise them: Yet shall it follow that euerie part of the Bone and proportion of a Gristle or Ligament shall performe a proper Action? One and the same iuyce is common to all the Particles of the same Similar part. Wherefore this subdiuision of a particular Action in my opinion is not allowable.

But I conclude from that which hath beene said, that some parts doe performe a double office, namely, one common to all other parts, another proper which is committed to them and to no other parts; and yet tending to the vse of the whole. And this office or function is three-fold, to wit, Animall, Vitall, and Naturall: But what euerie one of these is, and how manifold, we haue before declared, and therefore they are here onely presupposed.

Some parts haue a double action, some onely one.

Moreover, some actions be manifest by themselves, yet their Organ is obscure & hidden, others be cleere and manifest both of themselves and in respect of their Organ, others be obscure both in themselves and in their Organ. I call that action manifest of it selfe which is sensible and may be iudged by the Sense; and that obscure of it selfe which doth not appeare but from those *workes* which proceed from it. I call also that manifest by the meanes of his Organ, whose Organ doth presently appeare, & in this without all doubt do all consent: but I account that obscure in regard of his Organ, when the action doth appeare, yet the Organ doth not presently bewray it selfe without much study, and discourse of the Mind, which is held of some onely for probable where about many doe dissent. Those which be manifest both in themselves & by their Organs be these; vociferation, pulsation, respiration, the locall motion of the parts, expulsion of Excrements, the expulsion of Vrine, the

what action is manifest of it selfe, and obscure of it selfe

the emission of the Seed, &c. In respect of both, with *Galen* in the 8 and 16 Chapters of his Booke *De Usu Partium*, are the apprehension of the Hand, the walking of the Feet, chewing, vision, hearing, &c.

Finally, these are esteemed obscure in respect of both; the transmission of the Blood, the carrying and recarrying of the Spirits, the generation of Animall Spirits, the production of Vitall, the sucking of Urine out of the Blood, Chylification, Sanguification, and the generation of Seed.

QUEST. V.

That Sense is not a pure Passion.

Whether the
object or the
organ doe
worke in the
Sense.

Their reason
which say
Sense doth
suffer.

That opinion
disproued.
1. Reason

2. Reason

Aristotle
thought the
contrarie.

Seeing therefore that vnto an action there doe necessarily concur an agent and a patient; the *agent* for to worke, and the *patient* to be a fit subiect for the *agent*, and to receiue the action: It may now be demanded whether the action proceed from the Organ vnto the sensible object, or from the object vnto the Organ, and whether this be to be accounted an *agent* the other a *patient*, or on the contrarie. Concerning this point there be diuers opinions of Authours, for some maintaine Sense to be passive, others active, others both active & passive. *Aristotle* doth contend for those which would haue sense to be passive, especially in the 118 Text of his second Booke *De Anima*, where in expresse termes he affirmeth, that to *perceiue* is a kind of suffering, and also calleth the object an *agent*: againe, in the 51 Text of the same Booke he saith, that Sensation hapneth in that which is moued and suffereth: And he seemes most exactly to demonstrate it in the 12 Text of his 7 Booke of Physicks, saying, *That the Senses are altered, for they suffer, and their action is a motion through a Body which suffers in the Sensation.* So that it may be gathered out of these places of *Aristotle* that Sense is made passively, that is, that the act of Sensation is not made by the Sense, but by the sensible object, & that the Sense doth nothing else but receiue the Species from the thing objected and suffer from it: But this opinion though it be approued of many and be held for *Aristotles*, yet it is neither agreeable to *Aristotle* nor to the truth. That the places cited out of *Aristotle* do not confirme this we will proue by and by, when as by many reasons we shall haue demonstrated how far distant it is from the truth. For first, If the Sense should only concur passively vnto Sensation, that is, if Sensation were only a reception of the sensible Species, then we must needs euen when we are asleepe heare, smell & see; seeing therefore that although when we are asleepe some certaine noyses or sounds be carryed to our Eares, & some odors do strike the Nose-thrills, and colors (if so be we sleepe with our Eyes open as some do) be presented to our Eyes, yet we do not heare, or smell, or see; it will follow necessarily that some thing else must concur vnto Sensation beside a simple reception of the sensible Species. Add further, that though we receiue a visible thing into our Eyes, and a sound into our Eares, yet we neither see nor heare when we are intent another way or haue our vnderstanding exercised in greater matters. Wherefore there must be some part of the mind present in Sensation; and hence it is that we sometimes seeke a small thing and yet see it not though we be verie neere it, and though it be already receiued into the Eye: Surely this is an argument most euident that the mind must be applyed to that thing which we would see, & that some thing more is required to Sense then the bare reception of the Species, for else a Glasse might also *perceiue* in as much as it doth receiue the Images. Moreover, if ouely the reception of Species were a Sensation, all action should proceed from the sensible Species, & that Species should be so prompt vnto action that it would worke euery where & vpon euery subiect, and so would make Sense; euen as heat doth make hot euery where & euery thing; but this is impossible, for who euer affirmed that Sense was made out of his proper Organ. Sensation is not therefore an action only of the sensible Species. Neither was it *Aristotles* opinion, for in the 37 Text of his 2 Booke *De Anima*, he teacheth the plain contrary, & affirmeth determinately, that the Soule is the efficient cause of Sensation, and therefore not the sensible thing; and in the 9 Chapter of the 9 Booke of his *Metaph.* he proues that vision is an action of the sight: and what can be more manifest then that which he expresseth in the 2 Chapter of his Booke *De Sensu & Sensili*, where he reprobeth *Democritus* for saying that vision was an operation of the object: and propounding the conformance of the similitude which the sensible thing hath with the Organ, he saith, *The sensible thing causeth the Sense to worke*, as if he should say, *The object doth excite and prouoke the Sense vnto action.* The point is as cleere as the Light; but yet what shall we answer to those contrarie places, quoted euen now out of *Aristotle*? For it seemeth in them to be plainly affirmed that Sense is passive. But I defer the reconciliation of this contradiction till the 7 Question, where you shall haue also *Cass. Plac.* his resolution.

QUEST.

QUEST. VI.

That Sense is not a simple Action.

THat Sensation is not a meere passion, is plaine from that which hath beene said. Now it is to be considered, whether it ought to be called an Action, that is, whether Sense doe *perceive* onely by doing or acting. And that setting aside all digressions, I may come to the matter; I say, Seeing euerie Agent in doing and acting doth also suffer againe, it followes necessarily, that the Sense doth continually suffer some-thing from the sensible Obiect: For there is no Man ignorant that to the effecting of Sensation it is necessarie that the Sense be conuerted into the nature of the sensible thing, but it cannot be conuerted but by alteration, because things of an vnlike nature cannot be made of one nature, except the one of them be changed, but the Sense & Obiect be of an vnlike condition. And this is it whereupon *Aristotle* so often beateth, that the Sense is *potentially that which the sensible thing is actually and really*, and except the Sense doe passe into the nature of the Organ, Sensation cannot be performed. Whence it followeth, that the sensible thing doth alter the Sense and turne it into it owne nature, and therefore *Aristotle* often times calles Sense an alteration, for so Sense is made. Now if the Sense be altered and changed by the Obiect, it is necessarie that it must suffer, because the sensible thing when it altereth the Sense worketh vpon it. Hence it is more then manifest that Sense is not perfected by a simple Action.

Passion is
necessarie to
Sense

The Sense
and the obiect
be vnlike

The Obiect
must alter the
Sense

QUEST. VII.

CASSERIUS PLACENTINVS his opinion.

IF therefore Sense be perfected neither by Action nor Passion, how shall we say that it is performed? I answer, that it is absolued and perfected, neither by Action only nor by Passion only, but by both together, that is, both by Action & Passion. That Action is requisite vnto Sense, is proued by the Negative part before refuted. We will add some Arguments wherewith we are purposed for the present to confirme the Affirmative. And first, If Sense should be made without acting, it would follow, that the Vegetative facultie should be more noble then the Sensatiue, because that to *doe* is more noble then to *suffer*, but no Man doubts that the faculties of the vegetatiue Soule are Actiue, wherefore least we should fall into an absurditie vnheard of and monstrous, we will grant that the Faculties of the Sensatiue Soule are also Actiue. Furthermore, if the Senses should not *work*, they were in vaine giuen vs by Nature, because the Organ onely would haue sufficed vs for Passion. Againe, if the Sense were onely Passiue, neither could the Sight see, nor the Hearing heare, nor the Smell performe his owne function, neither were any such like *predications* true of the other Senses, because these *predications* do intimate that the Sense doth produce out of it selfe an act of Sensation. Fourthly, Sensation is an operation of life, and therefore proceedeth from an internall and actiue originall of motion, for life is an *internall motion*, performed by that which liueth. Vnlesse therefore you grant that Sensation is an Action, it cannot be an operation of life. Lastly, Sensation is a second act, and the sensatiue Soule is a first act: for to *perceive* is an operation of the sensatiue Soule, and therefore *Aristotle* beside many other places, affirmeth in the seuenth Chapter, and the 127 Text of the second Booke *De Anima*, that to *perceive* is something more then the suffering of the Sense, whereby it is manifest that Sense is an Action.

Sense is absol-
ued by action
and passion
together

That action is
requisite.

Reason 1.

Reason 2.

Reason 3.

Reason 4.

Reason 5.

Reason 6.

Reason 7.

Reason 8.

Reason 9.

Reason 10.

Reason 11.

Reason 12.

Reason 13.

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Reason 250.

Reason 251.

Reason 252.

and resolution of these difficulties, and the explication of a double truth, we must know that Sense is many wayes to be vnderstood.

First, as it is a reception of the Species, and so it is a Passion, for in that respect it suffers of the Obiect. And of this did *Aristotle* vnderstand that where he saith, *To perceiue is a kind of passion or suffering.*

Secondly, as it is a discerning and knowing of the Obiect by the Species receiued into the Sense, and so it is an Action, for so the Facultie doth worke vpon the Species, and so the Sight doth see, and the Hearing heare, and so of the rest; and so is *Aristotle* to be vnderstood, when he saith, that the Senses be Actiue.

Sense begins
in the Body
and ends in
the Soule

Thirdly and lastly, Sense is taken for both together; to wit, for an Action and Passion, when as the whole Sensation, that is, the perfect Act of Sense is vnderstood: For first, vnto the perfection of Sensation, there is need of Passion or an alteration of the Organ, from whence afterward follows the Action of the Facultie, which *Aristotle* did excellently note, where he saith, *That Sensation begins at the Instrument and Body, and is determined in the Soule:* as if he should say, the alteration of the Organ and the discerning of the Sensatiue Facultie doe accomplish a perfect Sensation. The same also must we vnderstand when he saith, that to *perceiue* is a second Act, and the Sensatiue Soule a first Act, because to *perceiue* is the operation of the Sensatiue Soule. Thus therefore may the difficulties propounded be easily resolued, and so *Aristotle* redeemed from contradiction.

QUEST. VIII.

How the Facultie is wrought in the Sense.

Question.

Sense is no alteration, but a knowledge of the alteration.

The Obiect cannot worke vpon the Facultie

The Facultie cannot change the Obiect

Solution.

The Organ is changed of it selfe, the Facultie as it is in the Organ

Seeing that (as *Galen* in the sixth Chapter of his second Booke *De Placitis* witnesseth) Sense is not an alteration, but a *discerning* or knowing of the alteration; because the Sensatiue facultie is not affected with the Obiect, but onely the Organ: It may therefore here worthily be doubted, how the Facultie can attaine to the knowledge of the Obiect, seeing it suffereth nothing from it, neither doth the Obiect *act* before the Facultie *perceiue*. For the Action of the Sensatiue facultie is a knowing and dijudication of the sensible thing: But it seemeth not to be possible, that the Sensatiue facultie can come to the knowledge of the Obiect, except that either the Facultie be some way affected by the Obiect, or the Obiect by the Facultie, but neither of these can be. For first, the Obiect cannot worke vpon the Facultie, because an incorporeall thing, is not affected by that which is corporeall. But the Facultie is incorporeall, and the Obiect corporeall. Beside, the Soule is not capable of Passion, and therefore neither are her Faculties capable. Neither can the Sensatiue facultie alter or change the Obiect. And this is plaine, as by many other reasons, so also because her sole and onely Action is Sensation. I say therefore, how comes it to the knowledge of his Obiect? And what is the efficient cause of the Dijudication or Iudgement, which the Facultie giues of the sensible Obiect, which we perceiue to arise from the motion of the Organ?

I answer, That the Sensatiue facultie doth suffer, and is changed by the Obiect, not by it selfe but by accident, to wit, as the Organ whose formall part and essence the facultie is, is changed by it. For seeing the Facultie is as it were the *idea* or *Forme* from whence the Action of the Organ doth proceed, when this corporeall Instrument is changed by the sensible Obiect, it remaineth that the Facultie it selfe (which together with his sensible Instrument doth grow vp into one Body, and so doth conspire vnto the same Action) is altered by accident and doth *perceiue* the alteration of his Organ. For all Organs of Sensation doe suffer by reason of their Body, but in respect of their Sensatiue facultie they performe an Act.

Passion doth affect the Facultie as it depends vpon the Organ; Action is the Dijudication or Iudgement, which is the office of the Sensatiue facultie, or of the whole Organ in respect of that Facultie where-with it is endowed: Not that the Facultie it selfe is altered or doth suffer, but because it *perceiveth* the alteration of the Organ.

QUEST.

QVEST. IX.

whether the knowledge of the Sensible thing be perfect in the Organ.

ALthough it be made manifest by that which hath beene said, that the proper action of the Sensatiue Facultie is the dijudication of the Sensible thing, yet there seemeth to be some difficultie behind: for, if the Facultie doe make this Iudgement of the object in the *Sensorium* or Organ, then those which sleepe with open Eyes should also see because the colour doth alter the Organ. In like manner a Sound might be heard, Odours smelt, and any Tactile qualitie might be felt by vs, seeing that the Organ is altered by the object, & yet when we are asleepe we neither doe see, nor heare, nor *perceiue* with any other Sense except the objects be very vehement. Haue therefore the Poets truly faigned that sleepe is the Brother of Death, because it doth deprive vs of all our Sense, yea of our verie Touch, inso much that it seemeth to extinguish the Creature and bereaue it not of Sense onely, but of Life also? Or else doe we *perceiue* while we sleepe, and know not that we haue Sense? The first cannot be, for although sleepe haue a great correspondency and affinitie with Death, yet it doth not deprive the Creature of Sense. For these things doe concur vnto Sense: A conuenient Object, an Organ fitly disposed, the alteration of the same Organ, and a Sensatiue Facultie, all which things we haue euen when we sleepe.

The Poets say
Sleepe is the
Brother of
Death.

Disproued.

What things
doe concur to
Sense.

First, The Object is present, for colour though we be asleepe, yet is it the object of Sight, and continueth to be actually an object as long as it is illuminated with the light of a Candle or with the day light; so also it is with Sounds, Odors and other objects of the Senses. The Organ is also present and so is the alteration of the same, seeing there is nothing which can hinder the operation of the Sensible Species vpon the Organ, or the alteration of the same. Neither is the Facultie wanting: for if the Facultie of one Sense should faile, all the Senses would be forfeited, and so of a living Creature should be made a Plant deprived of Sense and Motion.

Moreover, though we sleepe, yet our Organs liue and they liue by the Soule. If therefore the Soule with all her Powers and Faculties be wholly in the whole, and wholly in euerie part, it must needs be that if the Creature liue the Faculties of Sense must be present in euerie place where the Soule is. The Soule therefore is in the Organs of Sense, yea euen when we are asleepe, except you will say that the Soule dyes when we fall asleepe. Wherefore it necessarily followes that the Facultie of Sense is there also present in the Organ.

The Soule
with her Fa-
culties is who-
ly in the whole

Seeing therefore in sleepe we haue the object actually prepared vnto Sensation, seeing also the Organ fitly disposed is not wanting, and the iudging Facultie at hand, and that nothing more is required vnto perfect Sense, it is not to be doubted but that Sensation may be absolued in the Organ & Iudgment also giuen of the object euen when we are fast asleepe. But the reason why we doe not perceiue this Sensation, is, not because we haue no Sense at all, but because we know not that we haue Sense.

We haue sense
in sleepe but
know it not.

QVEST. X.

That by our outward Senses we doe not know that we haue Sense.

HAT we doe *perceiue* by the Organs of our Senses is euident enough by that which hath beene said, but it is doubtfull and vncertaine how we shall know that we haue Sense, seeing that this knowledge is not gathered from the externall Senses, for whatsoeuer is *perceiued* by them must be their proper object, but Sensation is the object of no externall Sense. Moreover, the externall Senses know nothing but externall things: but the acknowledgment of Sensation is no externall but an internall thing: wherefore it cannot be *perceiued* by the externall Senses. Thirdly, if together and with the same Sense we should *perceiue* and take knowledge of this perception, it would then necessarily follow, that the act of *perceiuing* and the object of Sense should be one and the same thing, which how absurd it is, I refer me to any Man to esteeme. Lastly, we doe not at the same time perceiue and iudge of that which we haue perceiued, but some-what after the act of Sensation we know that we did perceiue: a manifest argument that the one is a diuers act from the other,

and that with one Sense we doe perceiue, and with another know that we did perceiue. But this may especially hence be conuincd, that blind Men though they doe not see, yet they perceiue that they doe not see: seeing therefore the Organs of their Sight are vnfit for vision, it doth necessarily follow, that it is by another Sense that they perceiue themselves not to see. Now if it be by another Sense that we know that we doe not perceiue, surely it is another Sense also by which we know that we doe perceiue.

QUEST. XI.

Whence it is that we perceiue that we haue Sense.

We know not
that we per-
ceiue by Vn-
derstanding
nor Reason

IF therefore none of the externall Senses doe performe this Function, what may it be, is it the worke of our Vnderstanding or of our Reason? No: for this action is common to brute Beasts which be destitute of Reason, for they know when they doe not see, or heare, or smell, and so in the rest. And that they know so much may easily be gathered by the opening of their Eyes when they be shut, and pricking vp their Eares when they would see or heare. Neither need we wonder hereat, for they are enriched with some Functions that come neerer vnto Reason it selfe, as I might easily proue by many instances of diuers Creatures out of *Aristotle* and *Pliny* and other Historians if I thought it pertinent to this place. Seeing therefore vnreasonable Creatures do know when they *perceiue*, that is, haue vse of their Senses, it followeth necessarily, that that knowledge is not a worke of Reason.

It is no worke
of the Phan-
tasie.

we know that
we perceiue by
the Common
Sense.

Neither is it any worke of the Phantasie, in regard that it worketh after the act of *perceiuing* when the obiekt is not present; but the Phantasie ought to iudge (at least then when we haue vse of Sense) that we doe vse it, and after Sensation does nothing, whence *Aristotle* in the 136 Text of the third Booke *De Anima*, handling this point affirmeth, *That this knowledge of Sensation is wrought in the first Sense*. And this Sense is the common Sense, so called because it is proper to no one Sense, but is equally common to all; for Nature hath alwayes endeauoured to bring a multitude into an vnitie so much as possible may be: wherefore she hath ioyned in one common Sense all the outward Senses, whereinto as Lines going from the Circumference into the Center they may determine: and this hath the Philosopher verie elegantly declared in the 30 Text of his third Booke *De Anima*, and calleth this common Sense the *Medium or meane* between the externall Senses, considering them as the Circumference, and this as the Center. This is that Sense by which we know that we heare and see and performe the Functions of the other Senses: this is it which being bound in our sleepe maketh vs ignorant of our Sensation: this is it which except it be present all the other Senses are vnprofitable: this is it which offereth to the Phantasie the *Species* which the outward Senses haue *perceiued*, and the Phantasies to the Vnderstanding: in a word, this is it without which neither the externall nor internall Senses, nor the principall Faculties of the Soule could consist entire and absolute.

QUEST. XII.

Of the number of the Senses.

That there be
five Senses.

That there be
five proper
obieks of the
Senses.

The number
of the Senses.

IT is receiued of all Men that the Senses be five in number, but especially of *Aristotle* in the first Chapter and 128 Text of his first Booke *De Anima*, who saith, that beside Sight, Hearing, Smelling, Tasting, and Touching, there can be no other Sense assigned. And this is also confirmed by Reason, because there be onely five Obieks; Colours, Sounds, Odours, Sapours, and Tactile qualities: if therefore there can be found no other proper obiekt beside these five (I meane of externall Obieks) it doth necessarily follow that there is no other Sense beside these; so also because these five mentioned seuerall Obieks are so proper vnto their seuerall Senses, that none of them is iudged of but by his owne proper Sense: I say it followes hence that there are no fewer Senses then five, because the Obieks are full out five.

Furthermore, this number of five Senses is also confirmed by the number of the Elements, for *Aristotle* in the end of the second Chapter of his Booke *De Sensu & Sensili* saith, that euerie Organ is assigned to a particular Element, namely, the Eye to the Water, the Hearing to the Aire, the Smelling to the Fire, the Touching to the Earth, and Tasting, because of his neere affinitie to Touching is resembled vnto the same Element.

Neither

Neither doth that which may be objected any way infringe or impeach this opinion, to wit, because there is one onely Sensative Facultie, therefore that there should be but one Sense: For the reason why the Eye discerneth colors, the Eare iudgeth of sounds, the Nose perceiveth saavors, is not from the Facultie but from the temperature of the Organ; for the Foot also would see if it were endued with a temperament convenient for the discerning of colors. That the Organs have Sense, they have it from the Facultie; but that they perceive rather this then that object, they obtaine it not from the Facultie but from the temperament of their Organ. Wherefore, whereas the Eye doth discern of colors, the Eare of sounds, and the Nose of odors, it is not because there is a certaine Visive, an Auditorie and Odoratorie or Smelling Facultie, but because one and the same Facultie carrying it selfe in euerie Organ after the same manner, doth diuersly proceed into act, according to the diuers temper of the diuers Organs.

Objection.
Solution.

QUEST. XIII.

Of the order of the Senses.

Having thus determined the number of the Senses, it followeth in the next place that we speake something of the order of them, to wit, whether we ought to begin with the Sight as *Aristotle* and almost all Philosophers do, or with the Touch which is a contrarie way wherein Physitians and Anatomists do walke, and these be the two contrarie Sects concerning this matter of order, for none euer made doubt about the interruption or breaking off the order; but how many Authors so euer there be they haue either placed Sight in the first place, Hearing in the second, Smelling in the third, Tasting in the fourth, & Touching in the fifth: or else on the contrarie haue put Touching in the first ranke, Tasting in the second, Smelling in the third, Hearing in the fourth, and Seeing in the fift & last place.

As concerning the first, it is the opinion of the Philosophers and of *Aristotle* especially, who, both in the 2 Booke *De Anima*, and in the 2, 3 and 5 Chapters of his Booke *De Sensu & Sensibili*, doth ranke them in this order. Moreouer this assertion seemeth to be grounded vpon reason, because this is the order of the Elements which do concur for a *meane* or other help to the Senses; so that euerie Sense in respect of that Element vnto which it is appropriated, ought thus to be placed, and according thereto should their order and frame arise.

Senses to be placed according to the order of the Elements.

Sight is then the first of all the Senses, because Fire hath the first place among the Elements; for Sight is fiery, both in regard of the Sense, for it hath an ingenite or inbred Fire, as also by reason of the sensible thing, for except there be Light proceeding from a fiery Body, there would be no vision.

The Sight is fiery.

Hearing is the second because it is aery, for Aire occupieth the second place; and the Hearing is aery, both in respect of the Sense, because it hath an inbred Aire, and in respect of the object, because the Sound is formed in the Aire, so that it is of the Essence thereof.

Hearing is aerie.

Smelling is put in the third place, because as it is the middle betweene the other Senses, so it is appropriated to an Element (if I may so say) disposed in the middest of the rest. For that which is a *meane* betweene the nature of Water and Aire, as *Galen* doth well witnesse in the 2 Chapter of his Booke *De Odor. Instr.* falleth vnder the Sense of Smelling; because that which is neither so thin or rare as Aire, nor so crasse and thicke as Water may well be concluded vnder the name of a Vapor. Now that Smelling is vaporous both in respect of the Sense it selfe and of the thing sensible, we may haue occasion to proue hereafter.

Smelling is vaporous.

The Taft deserues the fourth place, because Water succeedeth Aire, and to Water this Sense is referred, as well because of the Communication, as also in regard of the Essence of the Object.

The Taft is watry.

The last place belongs to the Touch, because the Earth is in the last and lowest place, of whose nature and qualitie this Sense of Touching doth participate.

The Touch is earthy.

QUEST. XIII.

A conformation of the order of the Senses.

That the Senses ought to be thus marshalled among themselves and propounded in this order, the constitution and conformation of the Organs doe giue vs sufficient prooffe: for the proper Instrument of Sight is vayled with a very dense and thicke couer; that of the Hearing is more rare; that of the Smell yet thinner then them both,

The order of the Senses proued by the constitutions of the Organs

Parts.

And by the
tenuitie and
crassenesse of
the obiects.And by the
necessitie of
the Medium
or meane.

which *Galen* in the ninth Chapter of his eighth Booke *De Vsu Partium*, hath very well obserued, where speaking of this Sense, he saith, *If the couer were so framed, that it might be no hindrance to the Sense, then it ought to be so much more rare then that of Hearing, by how much the obiect hereof is of more crasse parts then that of the Eare.* The couer of the Tast is not onely more rare, but it is altogether spongy, as we haue shewed before in the Membrane of the Tongue. Lastly, the couer of the Touch is most rare of all.

This order is moreouer confirmed by the qualities of the obiects, for the obiect of the Sight is the thinnest and finest of all the rest, yea after a sort spirituall and not corporeall. That of the Hearing is more crasse, and the obiect of Smell yet more crasse and thicke then either of them: Whereupon *Galen* in the aboue-named place witnesseth, that the obiect of the Smell is of more grosse parts then that of Hearing: for saith he, *By how much the Aire is exceeded by the Light in the tenuitie of parts, by so much is a vapour surpassed by Aire.* The obiect of Tast is much more crasse then the former. But the Touch being earthy, must needs be the most crasse of all. Finally, this must needs be the order of the Senses, in respect of the Medium or meane; for the Sight aboue all hath need of a meane, but Hearing hath lesse need, and the Smell lesse then it. Tasting as some thinke without any meane at all, but especially the Touch as we haue partly proued already, and haply it will againe fall vnder our Discourse.

Lastly, the position of the Instruments are a confirmation of this order, for the Organ of Sight is placed without, but the Organ of the Eare is a little more inner, and the Instrument of Smelling more inward then them both, that of the Tast is yet more hidden, and the Instrument of Touching is called by *Aristotle* *τὸ ἐν τῷ ὄντι*, that is, *existing within*. By these Demonstrations therefore is this order of the Senses sufficiently confirmed, to wit, because euerie one ought to be placed in this assigned ranke. The Sight and Touch be the extremes because they are most distant one from another, by reason that the obiect of Touch is corporeall and materiall, and the obiect of the Sight incorporeall and spirituall; the Organ of Touch is placed within, but the Organ of Sight without; the Organ of Touch is couered with a most rare & thin vaile, that of the Sight with a most dense and thicke couer, because Sight vseth a Meane, but Touch none at all. Lastly, the Touch is earthy, & the Sight is fiery. The Hearing and Tasting are lesse distant one from another, and the Smell is equally distant from them all, and therefore by good right challengeth the middle place.

QUEST. XV.

The Arguments of the Philosophers.

Sight is by
Nature before
the other
Senses.And more
noble.

ALthough those things which are alleaged in the precedent chapters, seeme to proue nothing else but the ranke or following order of the Senses, and if any thing doe infer a conclusion, it is onely probably; yet there be which doe contend for the primacie of the Sight with strong Arguments. And first, they say that Sight is the first by Nature, as *Aristotle* witnesseth in the seuenth Text of his second Booke *De Gener. & Corrupt.* Wherefore if we will obserue the order of Nature, we must begin with the Sight.

Secondly, that which is more noble then the rest, doth deserue the first place. But Sight not onely in respect of the Sense, but of the Organ also, yea of the meane and obiect doth excell all the other in dignitie. To these we add, that Sight is more liable to our vnderstanding, and therefore we are to treat of it in the first place, because many things are found in it more facile and easie which also may prepare the mind vnto the knowledge of the other Senses: for the Organ thereof is very conspicuous, the meane is manifest, the obiect is clear, and other things which in the rest of the Senses be very obscure, are perspicuous & known in this: neither is it a sufficient obiection to say, that in respect of the act of *perceiving*, this Sense is most hard and difficult to be vnderstood.

QUEST. XVI.

The Arguments of the Physitians.

Why we must
begin with
those which
be most
common.

WE come now vnto the Reasons which are brought for the confirmation of this opinion out of *Galen* and the Anatomists, and they are taken partly out of *Aristotle* and partly out of the Propriete of Order. For *Aristotle* in the 37 Text of his first Booke of *Physickes* teacheth, that we must begin with those things which be most common; both because (as *Auerroes* expounds it) those things which be most common are best knowne, and also because otherwise we should too often fall into *Tautologies*, or vaine repetitions.

And

And *Aristotle* himselfe gives an excellent reason of this his owne Position, to wit, because without the knowledge of those things which are more common, the lesse common cannot be knowne.

Againe, who will deny that the Sense of Touching is more common then the rest of the Senses? Who knowes not that this Sense is common to all living Creatures? Yea it is so common in all, that without it no Sense can be performed, in so much that the same *Aristotle* confesseth, that euerie Sense is a kind of Touching. Beside, Art is but Ape or imitator of Nature, we therefore in the tradition of our Arts should follow the order of Nature, in which order we must begin with those things which are first (not in intention as the former Sect affirmeth) but in originall & generation: wherefore according to the order of Nature Touch seemeth to be put in the first place. To these we may add, that this Sense is more knowne then the rest, for a Man hath this Sense more exquisite then any of the rest; and it doth of necessitie follow, that of that Sense which we enioy most exquisitely, we should also haue most certaine knowledge.

Touch is the common Sense.

Touch according to the order of Nature is the first.

QUEST. XVII.

The Authors owne opinion.

THough these two Sects haue some shew of difference, yet in my opinion they may be reconciled, so that neither of both may seeme any whit blame-worthy, because they contend about a matter which is of no great moment, their strife being not about demonstratiue grounds. But because the Schoole of Physitians hath the more weightie Arguments, I will more willingly cast in my Lot with them. Yet may any Man draw a reconciliation betweene them from the diuers consideration of the order. Some follow the order of Nature in their Writings, which order may be vnderstood to be double, to wit, either the order of originall generation, or of intention, that is, either by what order Nature doth worke, or what end she presenteth to her selfe in her worke. According to the former consideration the end is the last, but according to the latter it is the first.

A diuers consideration of order.

Againe, some in their deliuerie of Arts follow that order whereby the Art is more easily taught, as for example, some things that come behind cannot be vnderstood vnlesse some other things be premised before. Others obserue the order of dignitie; so that by this diuersitie of order being conferred with that which we haue said before, it may easily be gathered what we ought to conclude of either Sect.

QUEST. XVIII.

Whether the Senses doe need a Medium or Meane.

IT seemeth to be no hard Question to determine whether the Senses need a Medium or meane, because out of *Aristotles* Philosophy we haue as it were an Oracle, 1000 times repeated that *The object placed vpon the Sense doth make no Sensation*, especially seeing hitherto it is receiued for such an vniuersall principle and ground, that he which denyes it deserues not to be confuted. But weighing this as all other Theoremes in the equall Ballance of Reason, I am bold to demand whether this Position deserue the title of a Principle? As for *Aristotle* he acknowledgeth it indeed for a principle, and in many places resolueth vpon it for an infallible & vndoubted Axiome without adding any reason thereto: but whether herein he hath well done, and whether it be such a ground and principle or no, it will appeare by the due consideration of the conditions required in a principle.

An Axiome questioned.

The first condition therefore of a Principle is (as it appeareth *Ex Posterioribus Analyticis*) that it may be truly affirmed of euerie particular of the same kind, and in my iudgement saith *Casseri Placentinus*, this Axiome transgresseth this condition, because it agrees not to euerie Sense to haue a Medium, for that Tasting and Touching are absolved without.

Touching and Tasting without a medium.

But some may haply doubt how these two Senses can be performed immediatly, and yet a Medium be required to the rest. The answer is at hand, because the Organs of some Senses are so sensible that they would easily be offended with the contaction of their objects. So the Sight will not admit of the Touch of any thing, and a vehement motion whereby the Sound is generated would offend the Organ of Hearing if it should come immediatly vnto it.

The reason why the other are not.

Againe, A fumid exhalation which falleth in with the Sense of Smelling would hinder Respiration, and except it were transported through a Medium or meane, it would be offensive and hurtfull to the Organ.

Some Senses
perceive mate-
rially, others
spiritually, as
Sight.

Not the color,
but the thing
colored of-
fends the Eye.

The Taste and
Touch receive
reall qualities.

The Sight
doth especially
need a medium

The Hearing
less.

The Smelling
yet less.

Tasting and
Touching
none.

Lastly, some Senses doe *perceive* their objects not materially but spiritually; and then the *Species* must be drawne from the object through a *Medium*. Some receive them materially, and those never need a *Medium*. For a colour cannot really attain to the Organ, because an accident out of his subiect is nothing: Whereupon it followeth that not the colour placed about the Eye doth offend it, but the *coloured* or subiect of the colour. But put case that colour could really without any damage be imposed vpon the Eye, yet it would not moue the Sense, because it would condense and thicken the Eye: for by this immediate contacti- on the colour doth worke vpon the *Diaphanum* or that which is translucent.

The Touch and the Taste haue therefore no need of a *Medium*, because they doe not receive intentionall or abstracted *Species*, but reall qualities; for if they should receive spiri- tuall formes, then they must discern of them a farre off without the contacti- on of the ob- iect; for the *Species* are diffused into an ample distance; but the Taste and the Touch are not perfected without contacti- on.

We see moreouer in these Senses reall affects of the objects, which could not be vnlesse they should be *perceived* really: But these things shall be more at large discussed in their proper places.

For a plainer dilucidation of the truth, we must obserue that all Senses haue not alike need of a *Medium*; but there is a certaine order and degree of this necessitie. For the Sight doth especially need a *Medium*, because it is most of all spirituall, and there is no Sensation at all of a reall colour immediately placed vpon the Eye.

A *Meane* is also requisite to the Hearing, yet it hath lesse need thereof then the Sight, for a Sound imposed vpon the Hearing maketh a kind of Sensation, but very imperfect, name- ly, such an one as is offensive to the Organ.

The Smell in like manner hath vse of a *Medium*, especially if the smoaky exhalation be vehement; for then it hinders Respiration and hurts the Organ: yet an Odor may be *per- ceived* without a *Meane*. Whereupon when we would *smell* any thing perfectly, we hold our Noses close to it: so that the *Smell* seemeth to be in the middle betwixt those *Senses* which need a *Meane*, and those which are performed without it.

Taste also though it be made by contacti- on, yet requireth necessarily an humiditie, which may bring the Savors out of *power* into *act*. But Touching hath need of nothing saue the contiguitie of the Tactile body, being performed without the helpe of any other *Meane*. And thus I thinke it is plaine what we may determine of this Question.

QUEST. XIX.

What the Medium ought to be, and of what kind.



After we know which of the Senses doe need a *Medium*, it followeth that we make inquirie to find out what this *Medium* is, and how it ought to be affected. And herein we must first obserue that the *Medium* ought alwayes to be present, least when all things else requisite for Sense be fitly disposed, yet for fault of a *Medium* we be made lesse able to performe this act of Sensation. Wherefore the *Medium* by whose inter- position we *perceive* is not Fire, for this is not alwaies at hand but Aire, for this doth alwaies encompasse vs about, it is alwayes present, in it we lead our liues.

Secondly, this *Medium* should alwayes consist in a middle place betwixt the Organ and the object; for hence it hath the name of a *Medium*, yet so, that it touch both the Organ and the object, for otherwise it can not performe his office. But there is no Element which is continually contiguous with our Organs but the Aire.

Thirdly, it is necessarie that this *Medium* be void of all sensible qualities, for otherwise it would bring the object adulterated or defiled to the Organ, and affect the Sense with a proper qualitie of his owne. Wherefore no compounded body is fit for this function, be- cause all compounded things are sensible of themselves.

If you object that there be no Elements exquisitely pure, and that therefore none of them can be a fit *Medium* being themselves sensible. I grant indeed that no Element that is neere vs is perfectly pure, yet that Aire that is neere vs wherein we liue doth exceed the rest in puritie, and is cleere from all qualities except Tactile, so that it may be accounted for a *Medium* to all the rest of the Senses except the Touch.

And is there then one *Medium* seruing to all the Senses? Yea, for this is the conclusion which is inferred from the former premises, to wit, because this alone is most pure, and is alwaies present with vs, this alone is continually in the middest betweene the Organ and the object,

Fire is not
the medium,
but Aire.

2 Reason
why the Aire
is the medium.

The condition
of a medium
agreeth with
no Element
except Aire.

object, this is alwayes close adioyning and touching both the Organ and the object. The Aire therefore alone serueth for a *Medium* to the Sight as it is Tralucēt; to the Hearing as it is fit to transport Sounds; to the Smell as it is capable of Odors.

But it may be objected, that if the Aire be the onely *Meane* of the Senses, then would it follow, that Fishes which liue in the Water haue no Sense.

I answer, that for their Sight the Water serueth for a *Medium*, but other Senses they haue none (saith *Placentinus*) sauing their Tast & Touch, and these two haue no need of a *Medium*, or if they haue other Senses, yet are they but imperfect. But if any Man will yet more instantly vrge, that they haue the Sense of Hearing. We grant they may heare, but most imperfectly, and for such imperfect Sensation the Water serues in steed of a *Medium*. But we speake here of perfect Sensation, whereas the Sensation of Fishes is not simply perfect, but onely in their owne kind, to wit, so farre forth as they haue need of it.

Lastly, this condition of the *Medium* is required to the perfect performance of Sense, namely, that it be not too spacious or ample, and also that it be not too narrow or scant. But what is the limit or extēt of this *Medium*, that is, how farre it ought to extend it selfe, is impossible to be determined, for this limit or extēt must almost infinitely be varied, according to the magnitude, paruitie, and vehemencie, as also according to the vigour and strength, or imbecilitie and weaknesse of the Sense: For we doe not discern Mountains, Cities and whole Countreys but a farre off, and lesser things we doe not see except they be neere at hand. So we doe not perfectly and without offence to the Organ heare a vehement Sound, except there be a great distance betwixt the Sense and the object; nor a low voyce, except we be neere vnto it. And the same reason is of the rest.

The termination of the medium is diuers.

QVEST. XX.

What an Object is.

AN Object or that which is sensible, is a quality which moueth the Organ, and is iudged of by the Sensatiue Facultie. And although that which is Sensible be two-fold, proper or common, yet I conceiue this definition to be peculiar to the proper object; vnlesse haply it may agree to some of the common, and therefore we will seuerally define them both. Proper Objects therefore, as *Aristotle* witnesseth in the 63 Text of his second Booke *De Anima*, are those which cannot be perceiued with any other Sense, and about which the Senses in discerning are not deceiued. And this definition (of it selfe) agreeth to the thing defined. For in that sometimes the Senses erre about their proper Objects, it hapneth not of themselues, but from some accident, to wit, from the deprauation of such things as doe concur to this Sensation; as for example, when all things appeare yellow to those that are sicke of the Iaundies, that hapneth because the Eye is tainted with the yellow colour of choller; and when Aguish Men do iudge sweet things to be bitter, it comes also from choller where with the Tongue is affected, and that is from euent and accident, not from the proper condition of the Sense. Wherefore seeing that when such impediments or lets are remoued, and the Object, *Medium* and Organ are naturally disposed, the Sense cannot be deceiued about his proper Object, it is by good right thus absolutely defined.

An Object is two fold.

What a proper Object is.

The Sense is not deceiued about his Object.

How many proper objects there be.

For the number of these Objects, they are as many as are the Senses, for Colour is the Object of Sight, Sound of Hearing, Odors of Smelling, Savors of Tasting, and Tactile qualities of Touching.

Common Objects are those, which are perceiued, not of all the Senses as some would haue them, but of more Senses then one. Which *Aristotle* teacheth very well in his Booke *De Sensu & Sensili*, where he affirmeth, that they are therefore called common Objects, because they are common though not to all the Senses, yet at least to the Sight and Touching, for by these two are all things perceiued, though not after the same manner as their proper Objects, to wit, by sending a Species from them, or by attaining really to the Organ; but as it were, after certaine manners and conditions ioyned with the proper Objects in order vnto the motion of the Senses: so that they doe not absolutely and primarily moue and affect the Sense, but onely together with their proper Objects. And because the second do not worke without the first, therefore the common Objects are not perceiued by the externall Sense without the proper. And these common Objects are five in number according to *Aristotle*, Motion, Rest, Figure, Magnitude, and Number.

What a common object is.

When the common objects moue the Sense.

QUEST. XXI.

Of the Organs of the Senses.

What an
Organ is.

THe Organ or Instrument of the Senses (as *Aristotle* witnesseth in the 122 Text of his second Booke *De Anima*) is that wherein the power and force of perceiuing is seated. And this Instrument is the Eye in the Sight, in the Hearing the Eare, in the Smelling the Nose-thrills, in the Tast the Tongue, and for the Touch, though all the Skin, yet especially that of the Hand. But yet the vertue or facultie of Sensation doth not reside in the whole Organ, but in some certaine Similar Particle, of which kind is the Christaline humor in the Eye, the Nerue of Hearing dilated in the Eare, the Mamillarie Proccesses in the Smell, the proper Flesh or Pulpe of the Tongue in the Tast, and in the Touch the true Skin; the other parts of the Organs assist this Particle, keeping it as it were in tune, or preserving the harmony thereof from the offence and incurfion of outward iniuries; for otherwise this sweet Musicke, content and proportion, would by the ouer-vehement force and change wrought by excessiue objects be destroyed, which concordance being broken there can be no Sensation.

And thus much shall suffice to be spoken of the Senses in generall; we will entreat more at large of the particular Senses in their proper places, where also we will note some things concerning their Organs which will be worthy your obseruation. And first of the Sight according to the order we before obserued in our Anatomieall Historie.

QUEST. XXII.

Whether Sight be made by Emission or Reception, where the nature of the Sight is accurately explained.

Our particular Controversies concerning the Sight shall begin with that notable Question concerning the nature and manner of Vision or Sight, which is indeed rather Philosophicall then belonging to the Art of Anatomy; notwithstanding because *Galen* hath elegantly ventilated it in his Bookes *De Vsu Partium* and *De Placitis Hipp. & Plat.* it shall not be altogether impertinent to insert some collections in this place which yet we must fetch out of the secret mysteries of Philosophy.

There are three especiall or most notable opinions of the Philosophers concerning the manner of Sight. Some thinke it is made onely by Emission of some thing out of the Eye. Others onely by Intromission or Reception of some thing into the Eye. And the third sort contend, that it is made partly by Emission, partly by Reception or Intromission.

Of the first Sect there be diuers Authors, but all of them disagreeing among themselves. The Masters of the *Optickes* thinke that certaine beames doe issue from the Eyes and reach vnto that which is to be seene: the figure of which beames they conceiue to be Pyramidal, the Cone or Point whereof is in the Eyes, the Basis in the thing to be seene. *Pythagoras* thought that Sight was made by an Emission of Light out of the Eye vnto the Object, which Light is reflected againe vnto the Eye, euen as a Hand-Ball stricken against a Wall doth rebound backe from the Wall vnto the Hand with an equall force.

Empedocles, *Hippocrates*, and *Nicemus* thinke that Sight is made not by Emission of Light onely, but of beames also. *Plato* thinke that the Eye sendeth not any beames forth of it, but onely Light, and that it also reacheth not vnto the thing seene, but vnto a certaine or proportionable space of the Medium. *Democritus*, *Lucippus*, and the *Athenian Epicurus* conceiued that certaine Images or Formes did flow from all things through the Motes which be in the Aire. *Chrysippus*, and the whole Schoole of the *Stoickes*, thought that a certaine Spirit ascended from the Heart vnto the Apple of the Eye, which Spirit was extended as farre as the Object. And these are the different conceits of the Authors of the first opinion, whereby it is supposed that some thing is sent out of the Eye vnto the visible Object, which opinion the *Platonists* confirme by these Reasons.

First, they say that Witches doe fascinate or bewitch onely by beholding one with their Eyes: Whence it is that the Poet saith:

Nescio quis teneros Oculis mihi fascinat Agnos;

I wot not well what witching Eye,
My tender Lambes hath done to dye.

Secondly,

Three different opinions concerning the nature of Sight.

The first opinion of Emission.

The Masters of the opticke Art.

Pythagoras.

Empedocles.

Democritus.

Chrysippus.

The *Platonists* Arguments.

Secondly, they say that a Basiliske doth infect a Man, onely by seeing him.

Thirdly, that a Menstruous Woman doth infect a Looking-Glasse as it were with some materiall corruption.

Fourthly, that if a Wolfe behold a Man he will become hoarse.

Fifthly, that *Tiberius Caesar* is reported to haue astonished a Souldier, onely by casting his Eye vpon him.

Sixthly, that *Antipho* (as *Aristotle* reports in the third Booke of his *Meteors*) had his own Image euermore before his Eyes.

Seuenthly, if we did not see by emission how it comes to passe, that when we would see more exactly we draw the Apple of our Eye into as narrow a roome as we can, Is it not to this end that the beames and spirits going out of our Eyes may be more vnited?

Eighthly, if nothing were sent forth of the Eye, how could the Eye be so wearie with continuall looking?

Ninthly, if Vision were made by reception & not by emission, we needed not to conuert our Eye directly to the visible object, for we should see whether we beheld the thing or no.

Tenthly, we could not see the magnitude or figure of many things, for the Eye being so little a body cannot receiue such great objects into it selfe.

Eleuenthly, if it were by reception, then would it follow that the more we dilated the Apple of our Eye, the better we should see, because our reception would be large.

Twelfthly, diuers or contrarie Species or formes would together and at the same time be receiued into the same Eye, because at once it doth behold two contrarie objects, as blacke and white.

Lastly, the least thing should be as easily perceiued as the greatest, the contrarie whereof is manifest, for the sharpe Point of a Needle held vward to the Sky is not perceiued, because the beames being separated cannot meet in one, by reason of the paruitie of the object, but if we would see it, we must of necessitie with-draw our selues to the one side.

To conclude, the Eyes are of a fierie nature, for they are both pyramidall & continually mouable and neuer stiffe, but it is the propertie of Fire alwaies to send some thing from it, as light, beames or heat. These be the principall reasons of the *Platonists*, and of the Masters of the *Optickes*.

Let vs now lend our Eares vnto the Fautours of the other Sect, the Prince of which Company and opinion is *Aristotle* in his second Booke *De Anima*, and in his Booke *De Sensu & Sensili*, and his steps haue all the *Peripatetickes* followed, as *Alexander*, *Themistius*, *Auerroes*, and the rest: and these thinke that *Sight* is made onely by reception of some thing into the Eye, and not by emission of any thing forth: and that for these Reasons.

The opinion of the *Peripatetickes* that Sight is by reception onely.

First of all, because that Sense being a Passion it ought onely to be made by reception. So Hearing is made onely by the reception of Sounds. The Smell by reception of Odors. The Taste of Savors, and the Touch of Tactile qualities.

Their Arguments

Moreouer, they that haue more moist and humid Eyes doe alwaies conceiue the objects to be greater then they are, because the Species are represented in a greater shape by reason of the humiditie.

Thirdly, an ouer-vehement object doth hurt the Sense.

Fourthly, we see in a Looking-Glasse the Image of the thing opposite vnto it, which we could not doe vnlesse the Image of the thing were caryed from the object vnto the medium and so vnto the Glasse.

Againe, *Aristotle* in the third Section of his *Problemes* asks the Question, why the right Eye should with more agility performe his function then the left, and yet the Eares do both of them heare alike? He answers, that Faculties are actuated by doing, but the Senses and their Organs doe equally suffer.

Sixthly, old men discern better of such objects as be a farre off then of those which be neere, and that not because of the light, or the beames, or spirit sent forth of their Eyes, for they are very small, impure and darkish; but because the Species or forme coming from a remote object is made more slender & spiritual, and more apt to be receiued into the organi.

Seuenthly, the smallest Starres in the cleere Winter may be discerned, and not in Summer, because their Species or formes being receiued into a crasse and thicke Aire are there terminated and multiplycated: but in Summer by reason of the raritie and thinnesse of the Aire they cannot be receiued terminatiuely or definitely (for of necessitie we must vse our Schoole termes to expresse these matters of Art) neither yet be sufficiently multiplied that they should attaine vnto our sight.

Galen

Galen's
opinion.
Our opinion
that Sight is
made by
reception:

Galen in the seventh chapter *De Placitis*, and in the tenth *De Vsu Partium*, to the end that he might reconcile the *Platonists* with the *Peripateticks*, determineth that Sight is made partly by Emission, partly by Reception. Truly for my owne part I reuerence *Galen* as a Master, and he stands in no need of my patronage or approbation, he is sufficient of himselfe, yet as he was often wont to say, *Vincat utilitas*, Let profit preuaile; so we say also, *Vincat veritas*, Let Truth preuaile. I had rather therefore thinke with *Aristotle* (whom I esteeme & respect as another Nature, but an Eloquent Nature) that Vision is onely made by Reception of Species, and that nothing is sent forth of the Eye vnto the thing seene which may helpe the Sight, that is, neither Beames, nor Light, nor Spirit. The truth of this opinion may be strengthened with these Reasons.

The first
Reason.
That the Or-
gan of Sight is
watry & why

First, the Organ of Sight is watry; now it is the propertie of Water to receiue: that it is watry may be thus demonstrated. The Organ of Sight ought to be Tralucēt that there may be a kind of Analogy or proportion betweene the Obiect, the Meane and Organ, that is, betwixt the Agent and Patient. But of shining and cleere Bodyes, some are rare & thin, others more dense or thicke. The rare Bodyes doe easily receiue the Species or Images, but they do not retaine and hold them; so the Aire is full of Species, but they presently vanish away & are not perceiued by reason of the raritie thereof: nay and I say, that such Species cannot be discerned in a Glasse except they be retained by Lead, or some such like dense and thicke Body. That therefore these formes of visiblie things may be held and retayned in the Eye, there is required both a translucent and thicke Body, and of this kind is Water; for Fire and Aire be cleere indeed but rare. The Organ therefore of Sight is watry, of which nature also are the principall parts of the Eye.

The 2 Reason
which is
Alexanders.

There is a verie elegant Argument of *Alexanders*, which is on this manner. That which is sent forth of the Eye is either corporeall or incorporeall. But it is not incorporeall, because incorporeall things can neither issue forth of the Eye, nor change their place, nor be in the Eye as in a place. It is not corporeall, because then the Eye in one day would vterly be destroyed, neither could it in a moment be carried as farre as the Sky, because no corporeall substance is moued in an instance.

To these we add, that when the Wind doth blow it would be dissipated, and so there would be a Penetration of Bodyes which is against Nature. Now if you should thinke that the Aire would giue place to the corporeall substance going out of the Eye, there could be no Sight at all, because there would be no continuation of those Beames with the Eye but some Body would interpose it selfe betwixt them.

The Solution
of the *Plato-*
nists Reasons.

As for those Arguments which the Masters of the *Optickes* and *Platonists* oppose against this Truth, we will thus in order answer, repell and refell them.

First, we deny that Fascination or Bewitching is done onely by Sight, except it be by Magicke Art.

For the second and third, we also deny that a Basiliske or Menstruous Woman doe by their lookes infect any thing, but it is by reason of a certaine corrupt and poysoned vapour which breatheth out of their Mouth, Eyes, Nose-thrills, and from their whole Body, which by continuation and succession doth infect the Aire.

Fourthly, that which they obiect concerning Wolues, is more worthy of derision then of confutation.

As for *Tiberius*, he did not astonish his Souldiers by any Beames proceeding from his Eyes, but by his horrid and fearefull looke and countenance.

Sixthly, for *Antiphon* it is well knowne he was a Foole, and therefore the fault of the oc-cursion of his Image or resemblance alwaies before him was in his Braine not in his Eyes.

Seuenthly, we doe angustate or straighten the Apple of our Eyes, least by the externall Light our internall Spirits should be dissipated.

Eighthly, the Eye is wearied with looking, by reason of that force and endeaour which the Facultrie vseth to administer for the establishment or fixing of the Eye.

Ninthly, the Eye must be conuerted or turned toward the visiblie obiect, because there can be no Vision but by a right Line.

Tenthly, the magnitude of a thing is not receiued into the Eye, but onely the Species or Forme of it, which because it is a thing immateriall, may be wholly receiued into the Eye.

To the eleuenth, we say, that the dilatation of the Apple of the Eye doth exolue or spend the Spirits which are of absolute necessitie for the reception of the Species.

To the twelfth thus, both white and blacke colours may at one and the same time be re-
ceiued

ceived into the Eye, because they are received onely by an intentionall and incorporeall Species or Forme.

Lastly, the Point of a Needle is therefore not perceived, because it is not a proportioned object to the Organ. By these it is plaine and manifest, even to the dullest apprehension, that Vision is performed not by emission or sending forth any thing from the Eye, but only by reception of the Species into it.

But the nature of this reception is most obscure and folded vp in many secret difficulties, for the enodation whereof, that this secret may appeare evident, foure things are to be discussed of vs. First, what it is that is received. Secondly, where or into what part of the Eye this reception is made. Thirdly, when it is made. Fourthly, how it is made.

As concerning the first Question, *Democritus* and *Lucippus* thinke that corporeall objects are received. *Epicurus* suppoeth onely the Beames of the visible object are received. *Alexander* that the Image onely of the thing is received, not as it were in a Subject, but like as in a Glasse. We agreeing with *Aristotle*, thinke that onely the Species or Images are received, and that the qualitie of these Species is incorporeall, immateriall, indiuiduall, the Philosophers call it *intentionall*, which is produced in the *medium* or *meane* and Organ, and so multiplied by a simple effluence or emanation as Light proceedeth from the Sunne, and a Shadow from a Body. This Species, I say, is not it selfe scene, but it is that whereby we see, for onely the object is scene.

The Eye therefore may very well be compared to a Looking-glasse receiuing into it the Images of such things as are objected and set before it. For a Glasse doth receive all the Species, not sending any thing forth: yet in this doth the Eye differ from a Glasse, that there is no vertue of the Soule in a Glasse which can refer and transmit the Image received vnto any other thing as it were vnto a Iudge.

But some will haply demand here, if the Species or Image received be immateriall, how can it affect the Sight by seuering or gathering together of the Spirits?

I answer, that the Eye is not affected by the Species, but by the colour, according as it is more or lesse splendent or enlightned, for all enlightned things doe dissipate, by reason that our airy and splendent Spirits doe vanish into that light which is like vnto them: So white things, because they haue much light doe dissipate the Spirits, but blacke doe gather them because they are contrarie to the Spirits. So when night comes, the heat is recalled from without inward, and as *Galen* teacheth in his Commentarie vpon the fifteenth Aphorisme of the first Section, we sleepe longer in Winter because the Nights are then the longest.

Wherefore lucide and white objects doe hurt the Sight, yea sometimes they make a Man blind, because the visive Spirits being drawne out, and as it were intified by that which is like vnto them, doe breake forth of the Eye with so great a violence and force, that by such irruption, either the substance of the cristalline humor, or the coat thereof, or something else in the Eye (which hath many tender parts) is either broken, or at least suffers some notable alteration.

It will be againe objected, if the reception of the Species be immateriall, why should the Eye be wearied with continuall seeing? Why doe not Prominent and Goggle-Eyes see better then other, because they are more apt for reception?

I answer, that the Eye is wearied, not by the impression of Species, but by the force and endeavour which the Facultie vseth to doe his worke, which is especially to firme the Eye, or hold it stedfast and to containe the Spirits; but those that are Goggle-eyed haue not so good Sight, because their Animall Spirits are dissipated, which are especially necessarie vnto the Sense of Seeing, that being ioyned with externall Light they might transmit the Species vnto the interiour Sense.

The second Proposition was concerning the place of this reception, to wit, into what part of the Eye the Species be received. And here it will not be in vaine to examine the different opinions of Physitians and Philosophers. Some thinke that they are received into the substance of the Braine, grounding vpon the doctrine of *Galen*, who teacheth that all Sense is from the Braine. *Aristotle* saith, they are received into the *Pupilla* or Apple of the Eye, vnderstanding by the Apple the cristalline humor. *Galen* saith, some time into the cristalline, some time into the Cobweb-coat, which he saith, is smother and more polished then any Looking-Glasse. *Auicenna* sayes, they are received in the meeting of the Opticke Nerues, and thence it is (saith he) that the object appeareth single, because the visible formes are vnited in that coition or coniunction of the Optickes. We determine that they are received

Four things to be observed in this reception.

what it is that is received.

That onely the Species are received.

The Eye is like a looking glasse.

Of the place of this reception.

Aristotle

Galen.

Auicenna

ceiued into the Cristalline, because it is the principall and primarie Organ of Sight, placed in the verie Center of the Eye, and differing from all the other parts in substance, figure, and qualities. But if you would reconcile all these, then say, that the *reception* is made in the Cristalline, the *refraction* in the Coats, the *perfection* in the coition or meeting of the Optickes, the *perception* and iudging in the Braine.

Of the time
of reception.

Concerning the time of this reception, which was the third Question, all do agree in one, that vision is made together with the perception of the Species, but this perception is made in an instant, for the Heauen is seene all at once, because the Light which produceth or bringeth forth these *visible Species*, doth diffuse it selfe, and transporting them together through the Aire, placeth them in the extreme Superficies thereof, that is, next of all to the Eye-lid, so that when the Lid opens, presently the Species is offered to the *Pupilla* or Apple, and in a moment of time is ioyned there-with.

Of the manner
of reception.

Lastly, the manner of Vision is thus, it is made by the reception of sensible Species, not of Bodyes, which Species, although they seeme to haue some tast of the condition of their owne matter, notwithstanding they are not carryed materially and as Bodyes are carryed, but like the Shapes or Images of Bodyes, brought from the aspectible object vnto the *Pupilla* through the Aire (as a *meane*) by right Lines vnto an acute Angle. He that desires to heare more of the manner of Vision, let him read *Alexander* and *Simon Simonius*, a Man both for Physicke and Philosophy very excellent, commenting vpon *Aristotle* his Booke *De Sensu & Sensibili*.

QUEST. XXIII.

Whether any thing within the Eye may be seene, and whether it may be seene by it owne proper forme, or by another, where also are explayned some things concerning the nature of Suffusion and of Visions or Apparitions.

Whether any
thing within
the Eye may
be seene.

Having resolved that Ancient Question concerning the manner of Vision, we will proceed to the resolution of two other doubts, that so there may be nothing wanting that can be desired to the perfect nature of this Sense of Sight. The first therefore is, whether any thing which is within the Eye may be seene. Then whether that which is seene, is seene by his proper Species or by another.

The first
Reason.

That nothing within the Eye is visible may be thus demonstrated, *Aristotle* in his second Booke *De Anima* writeth, *Sensibile positum supra sensorium sensationem non facere. A sensible object placed above the Sensorium or Organ doth not performe any Sensation.*

Secondly, if any thing should be seene within the Eye, then would it follow that the object and the Instrument receiuing the object should be the same.

Thirdly, the Philosopher teacheth, that there be three things requisite and necessary vnto the Sense of Sight, the *Object*, the *Medium* or *Meane*, and the *Instrument*.

Lastly, Vision is made by the reception of such Species as are produced and multiplied in the Aire; but if any thing within the Eye should be seene, the Sight would not be made by the Species, but by a reall Object.

To these we will add, that it would also follow that the Grapy Membrane which is diuersly coloured would be seene, but that is not seene: wherefore we conclude, that nothing within the Eye can be seene.

That some-
thing within
the Eye may
be seene.
Authoritic.

Now on the contrarie, that something within the Eye may be seene, is proued by Authoritie and Experience. First, the Authoritie of *Aristotle* in the second Chapter of his Booke *De Sensu & Sensibili*, and in the fourth of his *Meteors*, seemeth thus to perswade vs, for (saith he) when the Eye is rowled or moued in the darke, something may be seene within the Eye. This Authoritie is also backed and confirmed by Experience, for in Visions or Phantasmes which doe vsually goe before Suffusions, there doe appeare certaine figures, magnitudes, positions, and diuers colours, all which are resident in the Eye, and not in the Aire, for then they would be equally perceiued of all Men; and when a Criticall euacuation of Blood by the Nose is ready to follow, there are seene afore the Eyes certaine red shadowes which they call *Marmoryga*. But that these things may appeare more plaine and euident, it will be behoofefull to note a few things concerning the nature of Visions or Phantasmes.

Two kinds of
Visions.

Concerning such Visions, some are (according to *Galen* in his fourth Booke *De Locis Affectis*) of Idle-headed Men, by reason of the wandring and vncertaine motion of the

Images;

Images; and so Franticke Men doe hunt after Flyes, catch at a Flocke or Feather, pickle at Strawes, and are terrified, yea start and flye from vaine and false Images. These Visions are not Diseases of the Eye, but they are Symptomes of the Braine and of the Imagination.

Visions by the fault of the Braine.

There are also other Visions and representations which are proper to the Eyes and the externall Sensitive Facultie; when false Phantasmes doe obtrude and offer themselves to the Eye: For as *Anicen* writeth, there may appeare some small Bodyes in the Aire, and diuers mingled colours which indeed are nothing. This Vision is tearmed by the *Arabians* Imagination. But *Galen* defines it to be an externall apparition hapning by reason of a darke or cloudy vapor which is betwixt the cristaline and the horny Coat. It is most what a Symptome or signe of a depraued Sight, because certaine outward colored things do appeare which indeed are not; the Eye iudging that to be without which indeed is within it.

Visions proper to the Eyes.

What a Vision is.

The cause of this Symptome is acknowledged of all to be that shadow or cloudy and darke vapour which doth interpose it selfe between the horny Coat and the cristaline humor. I called it darke or shadowy, that is, Imperuious (as the *Barbarians* say) they meane not bright or translucent. For if that Body which is betweene the horny Coat and the cristaline were translucent, these Visions would not run before the Sight, but the *Species* of visible things that are pure and not mixed, would haue been carried to the cristaline.

The cause of such apparitions.

The place of this small Body or vapour is the whole space from the horny Membrane vnto the cristaline: For if this vapour had been contained betwixt the cristaline and the coition or meeting of the Opticke Nerues, it would not haue raised any such representation in regard that the whole reception of the *Species* is made in the cristaline alone. But if peradventure this vapor be mingled with the glassie humor which doth hinder the arriuall of the internall Light, it would either diminish and weaken this action of Seeing, or else vtterly extinguish it.

The place of this Vapour.

It is manifest therefore, that in the beginnings of Suffusions, and in Criticall euacuations of Blood by the Nose, in the *Peripneumonia* or Inflammation of the Lungs, in the *Vertigo* or Giddinesse, in the loathing of meat or vomiting, there appeare Gnats and Flyes and certain red shadows called *Marmariga* before the Eyes; all which are not in the externall Aire, for then they should be seene of all Men, but are contained within the Eye. We will therefore thus determine the propounded Question. That some thing within the Eye may be seene, because the obiection is present, that is to say, an interposed Body, a *Medium* transluide which is the waterish humour, and the principall Organ of Sight which is the cristaline humour. Yet we affirme, that this Vision is not perfect. The Reasons which are alleaged for the contrarie opinion, and the Authorities of *Aristotle* are to be vnderstood of perfect Vision.

What we hold

But there is another more obscure Question yet to be resolved, namely, whether that which is within the Eye when it seemeth to be in the outward Aire be seene by a proper *Species* of it owne or by a strange *Species*?

Question.

I answer, that it is by a strange *Species*; for the vapour which is contained betwixt the horny Membrane and the cristaline, is not perceived in the shape and *Species* of a vapour, but vnder another shape contained in the Aire; yet this strange *Species*, when it is receiued into the Eye, it followes the nature, colour, figure and magnitude of that vapour which is already existent in the Eye: So if the internall vapour be greenish or yellow, it represents the *Species* of the externall obiection (as of a Wall or Booke) yellow and greenish; If the vapour be small and diffused, there doe appeare as it were flying Gnats; If it be stretched out at length, Haires doe appeare. Now if that which is in the Eye should be seene by a proper *Species* of it owne, the inner Grapy Coat which is diuers coloured would be seene.

Solution

Finally, the last Knot which remaineth to be vntied is this, Why that which is within the Eye seemeth to be out of it?

Why that which is within doth appeare.

I answer, That the cristaline humor being accustomed to the vision of externall things doth iudge whatsoeuer is within to be without.

Solution.

QVEST. XXIII.

Whether the Organ of Sight be Fierie or watry.

Concerning the nature of the Eyes the *Platonists* and *Peripateticks* are at great strife. *Plato* in *Timao*, because he is perswaded that Vision is performed by Emission of Light from the Eyes, doth therefore thinke that the Eye is of a fiery nature. The Eyes (saith he) doe participate of that Fire which doth not burne, but by illumination doth cheerefully draw the Day out of the Dungeon of the Nights. Now Fire, according to the *Platonists*,

Plato saith, it is fiery.

M m m

is

is three-fold. First, that which doth both shine and burne. Secondly, that which shineth but burneth not. Thirdly, that which burneth but doth not shine. And this opinion of *Plato* *Galen* seemeth to follow in his 10 Booke *De Usu Partium*, and in the 7 *De Placitis Hippocratis & Platonis*. For he calleth the Eye a bright Organ and the Sun-like part of the Creature.

The Platonists
Reasons

The Reasons of the *Platonists* be these. First, the Eyes of some Creatures doe shine and glitter in the Night, as of Night-Owles, and of Cats. Againe, some in vehement fits of Anger haue their Eyes as it were burning and enflamed. Moreouer, when the Eye is shot at one side, we see a kind of fiery glance like Lightning, and the Eye being rubbed in the darke doth yeeld a bright glimpse vnder the Finger. *Aristotle* affirmeth, that *Antiphon* had his own shape and Image continually before his Eyes. And *Pliny* reports many things of *Tiberius Caesar* in the 11 Booke of his Naturall Historie. *Galen* also in the 7 Booke *De Placitis Hipp. & Platonis* maketh mention how it hapned vnto one many Nights before he vtterly lost his Sight, that he perceiued a great quantitie of Light to issue forth of his Eyes. Furthermore, that the Eyes be Fiery may be thus demonstrated, because they are very agile, plyable and mouable: now facilitie of motion is from heat. They are also translucide, of a Pyramidall figure, and full of Spirits, because they performe their functions in a moment. To these we add, that to the most noble *Sensorium* or organ is due the noblest Element, which is the Fire. Againe, the Senses are of the same nature with the things which are subiected to them: but colours are of a Fiery nature, for so *Plato* defines colour to be a flame issuing from the body coloured. Lastly, the Eyes neuer grow stiffe as do other parts of the Body, whence it followeth that they are of a Fiery nature. On the contrarie part, *Aristotle* and all the *Peripateticks* doe contend that the Eye is Watry, but he that desires more satisfaction herein may read those things w^{ch} the same *Aristotle* writ against the *Platonists* in his Booke *De Sensu & Sensili*.

The opinion
of Aristotle
that the Eye
is watry.

The authority
of Hippocrates.

Democritus
Reasons.

We will subscribe rather to this latter opinion, and the same doth Diuine *Hippocrates* affirme in his Booke *De Locis in Homine*, The Sight is nourished by the humiditie of the Braine. Of the same mind also was *Democritus*, as *Aristotle* reports in his Booke of Sense. Lastly, Anatomie and the whole composition of the Eyes doth conuince this. For the principall part of the Eye which first of all causeth Vision, is all Icy, which part being drowned in the glasse humour, hath in the fore-part a Watry humour so disposed for a defence, and if the Eye be hurt or wounded, whatsoeuer doth flow from it is Watry.

Carpentarius
reconciling
Aristotle and
Plato is re-
proued.

Some haue laboured to reconcile *Plato* with *Aristotle* after this manner. There be two things to be considered in the Eyes which concur to this act of Vision. First, a most cleere Visiue Spirit flowing from the Braine through the Opticke Nerves: and secondly, the cristalline humor. Now according to this distinction they say, that in regard of the Spirits and the internall Light, as also of the enlightened object, the Eye is Fierie, but in regard of the cristalline it is Watry. But this distinction seemeth not to be altogether tollerable, for so euerie Organ should be Fiery, because the Organs of all Senses haue their Animall Spirits of the same nature, tenuitie and brightnesse. For there are not diuers kinds of the Animall Spirits, that some should be appointed to the Sight, others to Hearing: I therefore hold it better to affirme simply according to *Aristotle*, and indeed the truth it selfe, that the Organ of Sight is Watry.

The Reasons
of the Platonists
answered

Why the Eye
doth shine.

Concerning those Reasons which are produced in defence of the *Platonists*, they be of small moment; for the Eyes doe shine indeed, and oftentimes a bright splendour doth proceed from them, but not by reason of the Fire, but because of the tralucency, plainnesse and smoothnesse of the Cristalline and the Coats; for whatsoeuer things are smooth and neat doe shine in the darke, as Horne. Againe, it hapneth because the externall Light receiued of the cristalline doth not presently vanish. They are mouable, and for this cause called by the Poet *Faciles*, yet this is not from the Fire, but from an abundant and slippery humidity, from the Spirits and the fixe strong Muscles, by which it is an easie matter for a small Member to be moued.

Why they are
called spiritual

Why not stiffe

They are called Spirituall by reason of their action, for they performe their function in an instant, and because they receiue incorporeall & immateriall *Species* or formes produced and brought through the Aire, and continually offering themselves to the *Pupilla* or Apple. They are not stiffe, yet this is not because they are Fiery, but as *Aristotle* teacheth in his *Problemes*, because they are inuironed with abundance of Fat, w^{ch} Fat though it haue for his efficient cause a defect or weaknesse of heat, yet notwithstanding by a kind of reflection it doth augment the heat, & by his sliminesse doth hinder the ingresse of the Aire w^{ch} beateth vpon them. To these we ioyn the plenty of animall spirits, & the perpetuall motions of the Eyes.

QUEST.

QUEST. XXV.

Wherefore the Eyes be diuersly coloured.

On the other side, that the Eyes are coloured, euen our owne Sense doth teach vs; for some Men are Wall-eyed, some Mens Eyes Blacke, some Mens Sky-coloured, and others Greenish, and so in the rest.

A double ac-
ception of
Colours.

How the Eye
may be said to
be coloured.

The differences of the colours of the Eye.

Colors
direction of
ends of the
The second
The first
The third
The fourth
The fifth
The sixth
The seventh
The eighth
The ninth
The tenth
The eleventh
The twelfth
The thirteenth
The fourteenth
The fifteenth
The sixteenth
The seventeenth
The eighteenth
The nineteenth
The twentieth
The twenty-first
The twenty-second
The twenty-third
The twenty-fourth
The twenty-fifth
The twenty-sixth
The twenty-seventh
The twenty-eighth
The twenty-ninth
The thirtieth
The thirty-first
The thirty-second
The thirty-third
The thirty-fourth
The thirty-fifth
The thirty-sixth
The thirty-seventh
The thirty-eighth
The thirty-ninth
The fortieth
The forty-first
The forty-second
The forty-third
The forty-fourth
The forty-fifth
The forty-sixth
The forty-seventh
The forty-eighth
The forty-ninth
The fiftieth
The fifty-first
The fifty-second
The fifty-third
The fifty-fourth
The fifty-fifth
The fifty-sixth
The fifty-seventh
The fifty-eighth
The fifty-ninth
The sixtieth
The sixty-first
The sixty-second
The sixty-third
The sixty-fourth
The sixty-fifth
The sixty-sixth
The sixty-seventh
The sixty-eighth
The sixty-ninth
The seventieth
The seventy-first
The seventy-second
The seventy-third
The seventy-fourth
The seventy-fifth
The seventy-sixth
The seventy-seventh
The seventy-eighth
The seventy-ninth
The eightieth
The eighty-first
The eighty-second
The eighty-third
The eighty-fourth
The eighty-fifth
The eighty-sixth
The eighty-seventh
The eighty-eighth
The eighty-ninth
The ninetieth
The ninety-first
The ninety-second
The ninety-third
The ninety-fourth
The ninety-fifth
The ninety-sixth
The ninety-seventh
The ninety-eighth
The ninety-ninth
The hundredth

The cause of
the variety of
Colours.
Empedocles.

Aristotle.

M m m 2

appeare

appeare Tawny and splendent. The blacknesse therefore of the Eye is from the plentie and abundance of Humours, the Wall-Eye is from the paucitie and scarcenesse.

Auerroes.

Auerroes thinkes that the whitenesse of the Eye proceeds from coldnesse, because for the most part all white things are cold, as the Braine, the Fat, the Marrow, the Bones, the Membranes: and blacknesse from heat.

Galen opinion.

Galen in the 27 Chapter *Artis Parue*, referres the cause of Colours vnto the plentie, splendor, and scituation of the Christaline and Watry humours. For (saith he) a Wall-Eye commeth by reason of the plentie or splendor of the Christaline, or because of the prominent and bunching scituation, and also the paucitie and puritie of the thin and watry humour. But a blacke Eye comes either from the scarcitie of the Christaline or from the ouer-deepe scituation of it, or because it is not exquisitely splendid and cleere, or because the Watry humour is too abundant, and yet not altogether pure. Thus farre *Galen*.

Auicenna opinion.

Auicenna refers the cause of the varietie of these Colours vnto the Grapy Coat, which as it is diuersly coloured it selfe, so it doth produce diuers Colours in the Eye, a blacke Coat causeth blacke Colour, as a blewish Coat a Colour of the same kind, and his opinion doth *Vesalins* follow.

The first cause referred to the humours.

But to the end that we may reconcile the different opinions of so graue Authors, we doe acknowledge three causes of this varietie: the Humours, the Coats, and the Spirits. The Humours of the Eye are three: first the Watry, secondly the Christaline, thirdly the Glassie. This last because it cannot be perceiued and is placed in the hindmost part of the Eye, doth confer nothing or very little vnto the diuersitie of Colours: but this vertue of alteration and changing the Colour of the Eye dependeth most vpon the Watry & Christall humor. In these Humours also, three things are to be considered: Their Substance, Quantitie, and Scituation. By the name of Substance I vnderstand the puritie or impuritie, the splendor, darknesse, tenuity & density. The Quantity doth note the plenty or scarcity of the humor. The Site is either more hollow and profound, or more prominent and bearing out. There be therefore three causes in respect of the Christaline, of a wally and white Colour in the Eye: First, the plentie of the Christaline: Secondly, the puritie and splendor thereof: And his prominent Situation: for so the Christaline humor by his owne & proper brightnesse illuminateth the Watry humor and the whole Eye. By reason of the Watry humor there be two causes of this Wallinesse, the splendor and the paucitie or scarcitie of it, for a small and pure watry humor doth lesse hinder the Fulgor or brightnes of the Christaline humor.

The cause of Blackenesse.

Obiection.

The causes of blacknesse are quite contrary, as in the behalfe of the Christaline the paucitie or smalnesse of it, his impuritie and deepe situation: and in respect of the watry the impuritie and plentie is the cause thereof. But haply that which *Aristotle* writeth in the 14 Probleme and the 14 Section may seeme to contradict our Assertion, where he saith, the *Ethiopians* haue blacke Eyes, and those that inhabite the *North* white, but in the *Ethiopians* there is lesse plentie of the Watry humor, by reason of that Ambient Aire exiccating or drying vp all things: In those of the *North* it is more abundant.

Solution

I answer, that the Eyes of the *Ethiopians* be blacke, by reason of the paucitie of their visue Spirits (for they are resolu'd and dissipated by the heat) whereby it happens that the light of the Spirits fayling, the Eye appeares as it were darke or ouer-shadowed. But the *Northerne* People doe abound with many Spirits. The Intermediate colours doe depend vpon Intermediate causes.

The second cause of the diuersitie of Colours.

The second cause of the diuersitie of Colours in the Eye may be referred to the Coat called *Membrana*, that is, *Pupilla* or the Grapy Coat, for this onely because it is diuersly coloured, causeth a variegated or diuers coloured Eye. So in the circle of the Eye, which they call the *Iris* or Rain-Bow, diuers Colours doe appeare, because in that part the Grapy Coat is diuers coloured.

The third cause.

Lastly, we thinke that the visue Spirits doe also confer something to the varietie of these Colours; for thin, pure, cleere, and copious Spirits cause whitenesse, but crasse, impure, foggy, and few are the cause of blacknesse. Now that there be Spirits in the Eye is manifest by these Arguments: First, because while the Creature is aliue, the Eye seemes to be exceedingly stretched, neither is any part thereof loose and corrugated, and the one of them being shut, the *Pupilla* or Apple of the other is presently dilated, to wit, because the Spirits passe more plentifully through the Net-like-Coat into the Grapy. Lastly, because sometimes the Eyes appeare languid and obscure, sometimes cheerefull and splendid or bright.

How the Colour of the Eye is changed by the Spirits of the Eye. QV 137.

QVEST. XXVI.

Of the Muscles of the Eyes, and their motion.

Seeing the Eyes be as Scout-Watches, Night and Day watching for our good, it was of necessitie that they ought readily to be moued euerie way, that with facilitie they might be conuerted whither soeuer we would; and to this motion a Nerue of the second Coniugation, and fixe Muscles doe serue. The first whereof lifts vp: The second doth depresse: The third doth draw forward: The fourth draweth backward: And two doe lead the Eye about. By all these performing their functions together, and stretch- ing their Fibres, is the Eye staied and fixed. For it is not (as *Galen* would haue it, and almost all Anatomists following his steps) established or fixed by a seventh Muscle compassing the *Opticke* Nerue, because this Muscle is onely found in Foure-footed Beasts which looke prone toward the Earth lest their Eyes should fall out of their Orbes: which Muscle in a Man is neuer to be found. This motion whereby the Eye is thus firmed, the Physitians call it *Tonicum*, or a set Motion, and it is two-fold, the one *κατὰ φύσιν*, or according to Nature when the Fibres of all the Muscles are equally intended or stretched, so that the Muscles seeme then to be at rest: the other *παρὰ φύσιν*, beside Nature when the Eyes remaine fixt and immo- uable whether we will or no. Which position *Hippocrates* in his Booke *De victus ratione in morbis acutis*, calles a Congelation and Immobilitie or setting and fixing of the Eye. This fixednesse or immobilitie hapneth when the facultie of the Muscles which moue the Eye is resolu- ed, weakned, or wholly extinguished, or because these Muscles are all equally gather- ed or contracted into their heads. This posture of the Eye they call *σκληρὸν εἰσρόπτον*, that is, a ballanced or equall fixing of the Eye, which affect or disease is contrarie to that they call *ἰστρος*, wherein the Eyes haue a wandring and vnconstant staring, as a Horse looks that is full fed; whence also the Disease tooke his name.

There are therefore fixe Muscles of the Eye, not seuen; and of these, foure haue the gouernment of the right motions, two doe obliquely lead the Eye about. And thus may certaine differing places in *Galen* be reconciled, for in his tenth Booke *De Vsu Partium*, he saith, that there are onely foure motions of the Eyes: but in the fourth *De Locis Affectis*, he determines that there be fixe.

Concerning the originall of these Muscles, Anatomists are not all of one mind. Some of them suppose that they spring from the hard *Meninx* within the Scull, but we are of opinion that the foure right Muscles together with that oblique whose Tendon is compas- sed about with the Pully, do arise from that inside of the Orbe which is made by a portion of the Wedge-Bone: and this we are taught, saith my Author, both by experience and by Autopsie or Ocular inspection. But from the Membrane they neither ought nor can haue their originall. They ought not, because a Membrane of an exquisite Sense doth compasse the *Opticke* Nerue, and therefore the Muscles in their motions would compresse this Nerue and so offer violence to the Sight: They could not, because they should not haue adhered to a firme Basis or Foundation.

QVEST. XXVII.

Two obscure and intricate Questions concerning the motion of the Eyes are resolved.

WE will now proceed to discusse a very hard Probleme concerning the motion of the Eyes, the Enodation of which Knots (for ought I know) hath not as yet been performed of any Man. And it is this: Wherefore the Eyes, considering they haue seuerall distinct Muscles by themselves, are yet not moued with diuers motions, but are guided together, and at the same time with one and the same motion. Neither can it be that the right Eye should be moued, and the left stand still; neither can the right be lift vp, and the left depressed, which Identitie of motion is not to be found in any other part of the Body. For I haue free libertie at the same moment to moue my right Hand vpward, and my left downward. *Aristotle* propounds this Question in his *Problemes*, which thus he en- deauoureth to resolu. Though (saith he) the Eyes be double, yet there is but one begin- ning of their motion, and the same originall, to wit, in the Coition or meeting of the *Op- ticke* Nerues. He therefore refers the cause vnto that Coition.

The first Question.

Why the Eyes are moued together with the same motion.

The Solution of Aristotle.

Anicen the Prince of the *Arabians* seemeth to be of the same mind, and *Galen* in his Books of the Use of Parts, where he thinketh the *Opticks* do therefore meet in one, that one object should not appeare double. These things haue some shew of probabilitie, but they doe not giue vs full satisfaction: for the meeting of the *Opticks* doth confer nothing to the motion of the Eyes: the *Opticke* Nerue doth onely see and carie the visive Spirits vnto the *Christalline*, neither is it inserted into the Muscles of the Eye.

Aristotles
answer disa-
lowed our
Reasons

It is onely the second Coniugation which moues the Eyes; in that oppilation or stopping of the *Opticke* Nerue, and in the Disease which the *Arabians* call *Gutta Serena* the action of Sight doth wholly perish, & yet the motion of the Eyes is not a whit hindred; the meeting therefore of the *Opticke* Nerues doth nothing further the motion of the Eyes. Some haue obserued that in many Men who all their life long neuer complayned of their Sight, the *Opticke* Nerues were so framed, that they were continually separated, and did neuer meet together. It is therefore very fond and absurd to thinke that both the Eyes are moued with the same motion, because there is one onely beginning of motion in the meeting of the *Opticks*; seeing neither that Coition nor yet the *Opticks* themselues doe any whit further the motion, but onely the Sense of the Eyes.

The true reso-
lution of the
Question.

We doe acknowledge a double cause of this motion, the Finall and Instrumentall. The Finall cause is the perfection of the Sense. And this is the perfection of the Sense, that the Object appeare euen such as it is; but if the Eyes were moued with diuers motions, that one might be carried down-ward, the other vppward, surely euerie Object, though in it own nature one & the same, yet would continually appeare double, and so the most noble Sense would be deceiued, and the action of Sight would be imperfect. If this seeme harsh to be beleueed, you may thus make tryall of it. If you either lift vp the one Eye, or depresse it with your Finger, you shall see all objects double, and discerne the one to be higher, and the other lower, because the one Eye is moued vppward, the other down-ward. But if you shut either of them, this double apparition of the Object will vanish, although you presse that Eye with your Finger: Also if you moue your Eye to the right Hand or to the left, the object will not appeare double, because the Apples of the Eyes remaine both in one Line.

Question.
Solution.

But wherefore vpon the diuers motion of the Eyes the Objects are doubled, is a thing worthy to be vnderstood. *Galen* in the 13 Chapter of his 10 Booke *De Vsu Partium* writeth, that the Diameters of visible Cones or turbinated formes must be placed in one and the same plaine, least that which is but one should appeare double. For then because the beame of the one Eye doth not equally reach the Object, as neither doth the beame of the other, that which the Sense perceiueth twice, it perceiueth as if it were double or two seuerall things; which also hapneth in the Sense of Touching, for if one Finger be so folded with the other, that it be layd about it, and there-with a Man touch a Stone, the Touch will iudge that to be double which is but one. In the Palsie or the Conuulsion of the Muscles of the Eye, it hapneth that the Objects present themselues in a double forme, because the Eyes depart from the same Superficies: So also the *Opticks* being either loosened or conuelled, the *Pupilla* or Apple doth not retaine his equalitie, whence it commeth to passe that all things appeare double, & so sometimes a drunken Man will thinke all things that he seeth double. In like manner, some that are *Strabones*, that is, Squint-eyed, doe see things double, because one of the *Pupilla's* is either rayfed vp or depressed. But if the Eyes be in the same plaine, though they be two, yet the visible thing is presented simple before them, because the same Species, and the same magnitude at the same time is receiued of both the Eyes, and are together offered to the Common Sense, which doth not discerne any thing but that which is present.

The conclu-
sion.

We conclude therefore, that first in respect of the Finall cause (which as we haue often repeated out of *Aristotle*, is the first and chiefe cause in the workes of Nature) it is that the two Eyes be together and at once moued. I say, this is because it doth much tend to the perfection of the Sense. And Nature doth continually fit her Instruments as they may best further the Finall cause, w^{ch} whether you call the vse or the necessitie it is no great matter. And therefore she hath so disposed the Nerues of the second Coniugation which do carie the command of motion, and the Animall Spirit into the Muscles (which are therefore termed *Porters* and *Cadgers*) that in their beginning they are continuall, making as it were one Chord, whence it is that the right cannot be moued but the other will follow his motion. And this is a new and most elegant obseruation.

The second
question why
the disease of
the one Eye
onely doth
more offend vs

The other Question we discouer out of *Cassius*, to wit, wherefore the Disease of one Eye doth

doth more vex vs then if both were diseased? To wit, because when the one Eye is sound and according to Nature, and therefore is diuersly moued, the sore Eye is also moued there with. Hence it is that the mutuall and equall motion doth exasperate the payned Eye; for when a Member is affected it would haue rest. But if both the Eyes be affected together, the paine becomes more tollerable, for they both rest together, and from that rest they sooner attaine vnto their former naturall disposition.

Solution

QUEST. XXVIII.

Of the humours of the Eyes, whether they be animated parts.

THE Humours of the Eye are three, the Christaline, the Watry, and the Glassie. Of these the Christaline is the principall Organ of Sight, as *Galen* teacheth in the second Booke of his *Method*, in his eighth Booke *De Instr. Odoratus*, the eighth and tenth *De Vsu Partium*, and the first *De Sympt. Causis*. And these Arguments amongst the rest doe euince it: That this Humour is the most cleere and shining of all the rest: That it is seated in the middle of the Eye: That it alone receiueth the *Species* and Images of things: That it onely is altered by colours: And that in it is the concurrence and meeting both of Externall and Internall Light. And therefore when the beating of both the Lights vpon the Christaline is hindred by Suffusions and Obstruction of the *Optickes*, the action of Seeing doth quite perishe, as if a Candle should be extinguished or put out.

The cristaline is the principall Organ of Sight.

Now concerning this Christaline humour, there may three Questions be demanded. First, whether it be a Part. Secondly, whether it be a Similar or Organicall Part. Lastly, whether it performe the action of Seeing by his Temperature or by his Conformation.

That it is an Animated and liuing Part of the Body may be confirmed by Authoritie and also by Reasons. For Authoritie we haue *Galen* in the sixth Chapter of the first Booke of his *Method*, and also in the first Booke *De Sympt. Causis*, accounting the Christaline among the Parts. Reason also perswadeth vs no lesse, for it doth primarily & principally performe the action of Seeing, and actions are not but of Parts onely. Againe, it is nourished, and liueth, and is generated in the Wombe together with the other Parts. It hath moreover his proper Circumscription. And lastly, it is a Body adhering to the whole, and ioyned in the Societie of a common life, framed also and made for the vse and office of the whole.

That the cristaline is a part. Authoritie.

Reason.

But whether it be a Similar or Organicall Part, it is greatly controuerted. Some doe contend that it is not a Similar Part, because, say they, it is neither Bone, nor Gristle, nor Ligament, nor Membrane, nor yet any of those ten which *Galen* describeth in his Booke *De Inaquali intemp. De Elementis & De Temp.*

Whether it be a Similar part.

Contrariwise, it is proued to be a Similar Part in the sixth Chapter of the first Booke of his *Method*, for those, saith he, are called Similar Parts which may be diuided into Parts like themselves, as the Christaline and the Glassie humours in the Eye. And in another place he saith, That in euerie perfect Organ that is a Similar Part which is the beginning and cause of the Action; as in the Eye is the Christaline. But that it is an Organicall Part the situation thereof in the middle of the other Humours, his figure like a Lentile or Fitch, and the magnitude of it doe demonstrate which three are of the Essence of an Organ.

To this I answer, that a Similar and Organicall Part are not opposed one to another. It is no matter therefore whether you call this Christaline a Similar or Organicall Part: For it is Similar, both by reason of his Substance and Temperament, because it is wholly watry, pellucide or bright, and like it selfe in all parts. It is also Organicall by reason of the figure, whereupon *Galen* in his first Booke *De Sympt. Causis*, determines that some of the affects of the Christaline be Similar, as his dry distemper which maketh the disease called *Glaucoma*, and the moyst which makes that affect which they call *Nuxalopia*. Other affects are Organicall, as when it is moued from the naturall situation, vpward, down-ward, to the sides, inward, and outward. Add hereto the greatnesse, littlenesse, and the solution of continuitie. And whereas *Galen* doth make mention onely of ten Similar Parts, he meaneth onely Common Parts, which are found almost through the whole Body: for the Marrow of the Braine, and of the Backe, and the Humours of the Eye are Parts, and yet may not be referred to any of those Ten.

But it is a point of deeper contemplation, and requires more diligent inquisition to know whether the Christaline performe this act of Sensation as it is a Similar Part, or as it is Organicall, that is, whether by vertue of his Temper, or by the meanes of his Figure; yet *Galen* in the sixth Chapter of his first Booke of *Method*, seemeth to refer it to the Temper; for,

Whether the cristaline performe his function by his conformation or by his proper temper.

saith

saith he, the Christaline is the principall Organ of Sight, because it is altered by Colours, and this alteration is from the puritie and brightnesse of it; now the puritie and brightnesse comes from the Temperament. Indeed the magnitude, vnitie, Lentile-like figure of it, and his situation in the midst of the humors are not without vse; but they afford the same helpe vnto Vision that the other Humors and the Membranes doe, that is, they make it more perfect. It is therefore manifest enough by this that hath beene said, that the Christaline humour is a Part.

Whether the
glassy humour
be a Part.

But the Question is more ambiguous concerning the glassie and watry Humour. All the Ancients thought that the Glassie was the nourishment of the Christaline, and the Watry the Excrement of it. *Galen* in the tenth Booke *De Vsu Partium*, writeth, that the Glassie humour turneth into the Aliment of the Christaline; for, saith he, it could not be that the Christaline humour which is white, cleere, and splendent should be nourished by pure and meere Blood, because it doth much differ there-from in qualities; it therefore required an Aliment more familiar and neerer to it owne nature, and this proximitie and familiaritie is in the Glassie humour which is composed by Nature fit to make the Aliment of the Christaline. For this Glassie humour by how much it is thicker then Blood, and more white, by so much doth the Christaline exceed it in humiditie and whitenesse.

That it is a
true part.

But if the Christaline be nourished with the Glassie humour, then cannot the Glassie be an Animated Part, because no Part doth nourish another. Yet *Galen* in the sixth Chapter of the first Booke of his *Method*, nameth the Glassie humour in the Catalogue of the Similar Parts, and in the first Chapter of his tenth Booke *De Vsu Partium*, he thinks that it is nourished by *transmission* or Transumption by the Coat which compasseth it about. If then it be nourished it is a Part.

We suppose the Glassie humour to be no lesse an Animated Part of the Eye then the Christaline, for it hath a proper circumscription, it is generated in the wombe of the purest part of the Seed, it is augmented as the other parts of the Body, it is nourished with Blood, it receiveth Veines from the *Hairy Crowne*, it is couered with a proper Coat, and being once spent it will neuer be recovered.

How the glas-
sie humour
doth nourish
the christaline

They which say the Christaline is nourished with the Glassie humour, doe speake improperly: Indeed it prepareth the Blood for the Christaline by changing it, least the pure Christaline should be infected with a red colour, and with Veines; for it behoued that the Christaline should be deuoid of all colours; yet the substance of the Glassie humour doth not transforme it selfe into the Christaline, nor is assimilated into it. And (saith *Galen* in his Booke of the Eyes) the Glassie humour is affected to the Christaline, as the Stomacke is vnto the Liuer; but the Stomacke doth prepare and minister meat vnto the Liuer as a Cooke, and so doth the Glassie humour to the Christaline.

Aniceni
opinion.

Aniceni thinks that the Watry humour is an excrement of the Christaline, and therefore denyes it to be a Part. Add moreouer, that it is fluide like Blood, and hath no proper circumscription. But we call it a Part, because it continually keepeth the same proprieties of figure, puritie, and quantitie; because it performeth some vse vnto the Christaline, and is as it were a defence vnto it, and like a Spectacle to carry the Images vnto the Christaline: Wherefore *Aristotle* calles it the *Porter* or *Cadger of Images*. This humour also if it should flow out cannot be recovered, and such Effluxion doth wholly extinguish the Sight. But all these properties doe not agree with an Excrement. Moreouer, it is hereby demonstrated that it is not an Excrement of the Christaline, because the Coat called *Arachnoides* or the Cobweb doth intercede or come betweene these two humours.

Aniceni
refuted.

If they obiekt and say that it flowes vp and downe like Blood, and doth not adhere to the whole. I answer, that it floweth when it is out of the Eye, but not at all within the Eye, neither doth it change his place, but is continually contained in a certaine and proper Seat.

QUEST. XXIX.

Of the originall of the Optickes, their meeting and insertion.



Some thinke that this Opticke Nerue is not a whit inferiour to the Christaline humour in dignitie, vse, and necessitie. For *Aniceni* is of opinion that the *Species* and Images of visible things are hereinto receiued. We haue already taught (with *Galen*) that the Christaline humour is the principall Organ of Sight, and that the Opticke Nerue is the conueyer of the visue facultie and the internall Light, to wit, of the visue Spirit.

[But

But that the Historie of the *Optickes* may be made more manifest, there are foure things to be inquired into.

First, what is their originall. Secondly, where their insertion is. Thirdly, how they meet or are conioyned. And fourthly, whether they be hollow.

Concerning their originall and beginning there be diuers opinions. *Auicenna* thinkes they arise out of the forward Ventricles of the Braine: others out of the Center of the Braine: and some out of the After-Braine. We haue obserued, saith *Laurentius*, that out of the lower and hinder part of the Braine, neere vnto the Spinal Marrow, yea out of a part of the Spinal Marrow it selfe, within the Scull, two of the most large and soft Nerues of all the Braine doe arise, that is, the *Optickes*.

Diuers opinions of the originall of the *Optickes*.

They could not arise from the forward Ventricles of the Braine, because there were the Mammillarie Processes: Nor from the middle Basis of the Braine, because this place was appointed for the purging thereof: Nor yet from the After-Braine, because the Sight requireth a verie soft Nerue, but the After-Braine is very hard and not white. The *Optickes* therefore must arise from the lower and hinder part of the Braine, out of each side one, which being obliquely stretched out and separated, doe meet in one almost in the midst of their progresse.

The true opinion.

Concerning this their meeting, two Questions are to be resolued, to wit, how they meet, and secondly, why they meet.

Of the meeting of the *Optickes*.

The manner of their meeting hath not beene knowne till of late dayes: For almost all the ancient Physitians hold, that in their confection they thwart one another like a Crosse, (which thwarting or insertion is called *κρίσις*) and so the right Nerue is carryed to the left Eye, and the left to the right Eye. Others doe not thinke that they thus crosse and intersect one another but onely obliquely touch themselues. But we, saith *Laurentius*, some-thing more accurately and diligently contemplating the manner of this coition or meeting of the *Opticks*, do thinke that the Marrow is mingled and confused in the middle of either Nerue. For if they were onely contiguous touching one another, and not mixed and confused, the *Pupilla* or Apple of one Eye would not so in a moment be dilated when the other is shut. The *Optickes* therefore doe meet and are so mixed in the middle of their passage or iourney, that the one cannot by any Art be seuered from the other. This is the manner of the coition of the *Opticke* Nerues.

The manner of their coition.

Now it behooueth that we looke vnto the Finall cause, namely, wherefore the *Optickes* do meet. First, it was necessarie that they should meet for strength, to wit, that by this coniunction or embracing one of another, they might not suffer any violence in the whole length or tract of their Iourney: For being of all the Nerues the most soft, and creeping so long a Iourney, they would haue beene loose and flaccid, nor carryed in a right line into the *Pupilla* or Apple, vnlesse they had beene vnited in the middle of their passage. So Nature is wont to strengthen those things which are more soft and weake as it were with knots in the midst, as may appeare in the right Muscles of the *Abdomen* or Paunch.

Reason 1.

Secondly, it behooued that they should meet that they might keepe the same plaine and *Superficies* in the Apple: For vnlesse they had thus met they would haue departed from one and the same plaine: So the Eyes being deceiued would haue iudged a simple Obiect to be double: For it behooued (as we haue declared euen now out of *Galen* in the 13 Chapter of his tenth Booke *De Visu Partium*) that the Axes of the Visiue Cones should be placed in one and the same plaine, least the Obiect which is simple and single should appeare double.

Reason 2.

Galen in the 14 Chapter of his 10 Booke *De Visu Partium*, acknowledgeth a third cause of this their meeting, to wit, that the formes and images of visible things may be vnited: For though the *Species* be carryed through two Organs, yet they appeare single and not double. And this was *Aristotles* mind in the first Booke of his *Problemes* and the third Section, where he demandeth why the Eyes are together and at once moued? Because (saith he) they haue one beginning of motion, to wit, the meeting of the *Opticke* Nerues. And *Auicenna* is of the same opinion.

Reason 3.

But I doe not altogether approue of this cause of their coition: For *Resalins* writeth, that he obserued in a young Man, that these *Opticke* Nerues did no where meet, and yet he neuer in the whole course of his life complayned of any deprauation or infirmitie of Sight. *Aristotle* writeth in his second Booke *De Anima* & in the fourth of his *Metaphysicks*, that the Sense is neuer deceiued about his proper Obiect. What need is there then of this coniunction? Againe, if we obtained this by the coition of these Nerues, that the *Species* and formes

Reason 4.

formes of either Eye are vnited into one, then why should not those many things which are seene together appeare but one?

In like manner, though there be two Eares and two Nose-thrills, yet the obiekt doth not appeare manifold to the Sense. It is not therefore from this coition of the *Optickes* that the Obiect appeareth simple, but because the Apples of the Eyes are in the same plaine, and are turned toward the visible Obiect at the same moment.

Reason 4.

Fourthly, some would haue the *Optickes* to meet, to the end they might more fitly proceed out of the perforation in the Scull, and so might be carryed directly to the Eyes.

Reason 5.

Lastly, *Galen* in the 14 Chapter of his 10 Booke *De Vsu Partium*, conceiueth that they meet, that so the Visiue Spirit might passe from the one Eye into the other in a moment for the perfection of the Sight, so the one Eye being shut, we doe see more accurately with the other. And these are all the causes of this coition or meeting of the *Opticke* Nerues.

The insertion
of the Optick
nerues.

Let vs now follow on and declare the manner of their insertion. The *Opticke* Nerue doth consist of a double substance: An internall which is Marrowy, and an externall which is Membranous. The inner Marrow when it attaineth to the Christaline humour is dilated and so diffuseth Visiue Spirits through the whole Eye. Out of this dilatation ariseth a Coat which they call *ἀμφοτέρωθεν* or the Net-like Coat, which (as *Galen* teacheth in the second Chapter of his tenth Booke *De Vsu Partium*) doth neither in colour nor substance deserue the name of a Coat, but if you cast it into Water, you shall see it resemble the soft, white, and Marrowy substance of the Braine. But the outward part of the *Opticke* Nerue doth consist of two Coats, the one is propagated from the thin *Meninx*, the other from the hard; the one is spent into the Grapy Coat, the other into the Horny Membrane: Whence it is, that by the continuitie of this *Opticke* Nerue the Animall spirit is carryed euen in a moment vnto the Apple of the Eye.

Of the cauitie
of the Optick
nerue.

Concerning the last Question, which is of the inner cauitie of the *Opticke* Nerue, *Galen* writeth in the tenth Booke *De Vsu Partium*, that they are manifestly hollow, and therefore *Herophilus* called these Nerues *πόρος*, because they are perforated or holed through. But we doe not admit this sensible cauitie in Nerues, yet we would haue them to be the most soft of all the Nerues, and more spongy, that they might receiue and transport a more copious and abundant source of Animall Spirits.

QUEST. XXX.

whether the Light be the Obiect of the Sight.

Their reasons
which say
Light is the
obiect of sight

Here be some which doe determine that Light is the Obiect of Sight, grounding their opinion vpon this Foundation, because euerie thing which is seene either is Light, or it is seene by the Light, or as *Simplicius* saith, that which is seene is either Light, or neere a Kin vnto it, concluding hence, that Light is visible by it selfe, but colours and other things onely by the meanes of Light, in so much as Light is the cause wherefore they are seene. But none of these are true, and first of all that Proposition may not be granted, to wit, that whatsoeuer is seene is either Light, or is seene by the Light, or is very like to it. For if they take Seeing in so large a sense as to perceiue a thing with the Eyes (as it is necessarie that they must grant, for else we will deny that the Light it selfe may be seene) then would also Darknesse it selfe be seene, which neither is nor may be seene by the Light, neither is it of a nature like vnto it.

Some things
are seene in
the Darke.How the
Starres are
seene

Again, all things are not seene by Light, for there are some things which are made conspicuous onely by Darknesse, but in too cleere and splendide a Light they flye from the Sense, as the Scales and Eyes of Fishes, old rotten Wood, yea I say the Starres themselves, which therefore the Vulgar Imagine doe fall or set because they are obscured by the Light of the Sunne, and so taken from our Sight, but at the returne of the Euening Twylight, to wit, when the Light goeth away, and the Night approacheth, they are by degrees restored to our Sight againe, as in the Morning Twylight they after the same manner doe withdraw themselves by little and little from vs. Therefore euerie thing which is seene is not Light or seene by the Light.

Light is not
the obiect of
the Sight, be-
cause it is in
the Eye.

Reason and *Aristotles* Doctrine doe contradict this opinion: For we are taught by both these, that the Eye should be free from his owne Obiect, that so it may receiue it more sincerely: But the Eye both in regard of his whole frame and composition, and especially in respect of the Christaline humour where the reception of the Obiect is properly made, is especially light and cleere: Light therefore cannot be the Obiect of the Sight.

Moreover,

Moreover, to see, is not onely to know a thing with the Eyes (for this is too large a signification, and agreeth to many things beside the proper Object) but we do properly see that in which (when it is perceived with the Eye) the Sight is determined, and stayeth it selfe. But the Sight is not terminated in the Light, though the Eyes doe perceive it, but reacheth alwayes beyond it. Seeing therefore the Light cannot be truly seene, it cannot be the true Object of Sight.

Furthermore, an incorporeall Object cannot alter a corporeall Organ, except it proceed from a Body, that is, be a qualitie thereof, and then that alteration is attributed to the Body by the meanes of the qualitie; but that Vision be made, it is necessarie that the Organ be altered by the Object; the Light therefore because it is a bare qualitie (though they deny this) is not to be thought the Object of Sight, but some other corporeall Body wherein there is a visible qualitie.

Lastly, the Organ ought to be potentially that which the Object is actually: But the Light is actually incorporeall, and no corporeall Body is potentially incorporeall, vnlesse by the meanes of some actiue qualities, but no such actiue power proceedeth from the Light but illuminatiue and inlightning, which they thinke hath the nature of an Object. But they still object that all visible things must be reduced vnto some primarie Genus, which may be called an Object. Seeing therefore Light is the first of all (because by the helpe thereof other things are seene, but Light needeth no other helpe) therefore worthily all other visible things ought to be referred vnto Light as vnto their primarie and chiefe Genus, and so it remaineth that Light is the first and proper Object of Sight.

But besides that, it is denied that all visible things are seene by the helpe of Sight, as we said before, yet though we should grant so much, it would not follow that all Objects are to be referred vnto the Light, as to their first and chiefe Genus. For visible things are not therefore seene, because they are illustrated and made bright by the Light, but because they haue another affection which can alter the Visiue Facultie. We grant therefore that Light doth necessarily concur vnto Vision, but we deny that it is the immediate cause thereof. Moreover, it is true that those things which moue the Visiue Facultie ought to be reduced to some one principall Genus which is called an Object. Yet all visible things both proper and improper, with all which doe any wayes fall vnder the Sight, cannot be referred vnto any one Genus, and therefore not vnto Light.

The alteration of the organ is requisite to Vision.

The organ ought to be potentially the object.

Whether all objects be referred to the Light, as to the generall

After what manner visible things be seene

QUEST. XXXI.

Of the nature of Light, and what it is.

WE say therefore that the Light cannot moue the Sight, because an incorporeall thing cannot change a corporeall Organ, vnlesse it be disposed and fitted by certain Media or meanes vnto that alteration, but Light hath no actiue power beside Illumination. Against this some oppose and would proue that Light is a Body. First therefore they retort our owne Argument vpon vs. For as we conclude that the Light cannot alter the Visiue facultie; so they infer on the contrarie, that it is therefore a Body because it doth alter the Eye; and that it doth alter the Eye, they conuince by Experience, to wit, because the Light doth trouble the Eyes by mouing and tossing their Spirits, and so causeth some paine and griefe in them, which things cannot be done without alteration, which is proper vnto Bodyes; they therefore by good right conclude that the Light is a Body.

I answer (saith Placentinus) that though a Body be continually requisite vnto alteration, yet that alteration is not of the Body as it is a Body, but as it is such or such a Body, and so qualified; as for example, the Fire doth heat, not as it is Fire, but as it is hot; and as the heat it selfe doth proceed from the Fire, and doth alter cold things which are a good way distant from it, that is, make them hot; so also the Light issuing out of a lucide and cleere Body, doth trouble the Eyes, and produce other effects aboue-named. But as the heat of that Fire is not a Body, but a qualitie of the Body; so also it is not necessarie that this Light be a Body. We confesse therefore that alteration indeed cannot be made without Bodyes, yet this alteration is not to be ascribed to the Bodyes, but to the qualities of the Bodyes. In that therefore the Light doth alter the Eye, it is not because it is a Body, but because it is a qualitie of a Body.

This therefore maketh nothing for them which would haue the Light to be the Object of Sight; for the Light alters the Sight as it is a Light, that is, by illuminating; but this is not

Their reasons which proue Light to be a Body.

That Light doth alter the Eye.

Answer.

not

How Light
doth alter the
organ of sight

The first
Reason of
the contrarie.

But the Light
is not so
moued.

Penetration
of Bodies
impossible

What Light
is.

Euery thing
is either a
Substance or
Accident.

Obiection.

The second
Argument

Answer
to the first.
The Light of
the Sunne is
not ioyned
with the light
of a Candle.

not sufficient vnto Sight; for then heat, cold, humiditie, ficcitie, and other qualities should be the Obiects of Sight, because all these doe alter the Eye.

But beside these Reasons, there be almost innumerable others which doe conuince sufficiently that Light is not a Body, and they are especially drawne from the conditions of Bodies which doe continually and necessarily agree vnto them. For first of all, euery Body is moued in a certaine time and successiue, because of the resistance of another Body; for one Body cannot be moued vnlesse it driue and force another which did before exist in the place to which it is moued; for because Nature doth abhor vacuities or emptinesse, it must needs be that in euery place there must be a Body. But the Light not in any distance of time nor successiue, but in a very moment doth replenish the whole Hemisphere and Horizon by a suddaine diffusion, and doth goe through the whole space from the East vnto the West without any progression of time; whence it doth necessarily follow that it is no Body.

Secondly, euery Body hath his proper circumscription and treble demension, but this circumscription, and these dimensions are not at all competent to Light, vnlesse you will attribute them to the Light in regard of the Body wherein it is, but then it doth agree thereto onely by accident.

To this we will add, that there is no Body in Nature which is not diuisible into infinite Parts; but who could euer diuide the Light?

Moreouer, if it were a Body, some motion which Bodies haue would agree vnto it; for all Bodies are either moued vpward or downward, or circularly; but no such motion can be ascribed to the Light. It followes therefore that it is no Body.

Againe, if it were a Body, it should be either corruptible or incorruptible; but corruptible it cannot be, for then some thing should be generated of his corruption, because the corruption of one thing is the generation of another; but nothing is generated of the corruption of the Light, for if there were it would appeare, seeing the Light is so vast and immense. Neither yet is it incorruptible, for we see that when a Candle is put forth, the Light is extinguished. But if we should grant it to be a Body, how would our Aduersaries auoyd these absurdities which would follow therefrom? Should not there be a penetration of Bodies? For the Light doth penetrate all the parts of the perspicuous Body, and yet the nature both of the Light, and of the Body is preserued whole and entire. Seeing therefore that nothing is more impossible then this penetration of Diameters, as the Mathematicians auouch, it is altogether impossible that Light should be a Body.

Now that we know what this Light is not, it followeth that we make enquire what it is, which that we may obtaine, we will make a reduction into the highest *Genera* or kinds, which are two. For whatsoeuer doth exist in the whole Vniuerse, is either a Substance or an Accident.

A Substance this Light cannot be, for it doth not subsist by it selfe, but if the lucide or bright body be removed, the Light is also taken away: neither can it be separated from the lucide body. Moreouer, no Substance of it selfe is vnder the preception of Sense, but Light is by it selfe perceiued by the Sight: and this no Man can deny, because it is neither knowne by Touching, nor Tasting, nor Smelling, nor yet by Hearing, notwithstanding it is known: It remaineth therefore that the Sight doth iudge of it, and yet it is not therefore the obiect of Sight, as we haue before shewed.

Seeing therefore the conditions of a Substance doe in no sort agree to Light, it is necessarily inferred that it is an Accident; which notwithstanding many vncertaine Wits and ignorant doe deny, grounding themselves vpon this Argument, That if it were an Accident, then Light would mingle it selfe with Light in the same subiect; but it is not mingled, for there doth some distinction appeare betwixt the Light of the Sunne and a Candle when they are both together.

Secondly, they produce an Example of two Candles which make two shadowes out of one darke body; but if the Light of the one should be mingled with the other, and so be made as it were one, they would also onely make one shadow of one body.

But it is not so as they say. For, that the Light of the Sunne is not mingled with the Light of a Candle, doth not happen because it is no Accident, but because these two Lights are not of the same kind, for the one proceedeth from a body more pure and simple, the other from a more impure and materiall substance, so that it seemeth after a sort mingled with Smoake; and as a pure thing vpon an impure rideth aboue and remaineth distinct, least that which

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which is immateriall should be mingled with that which is materiall; so it is impossible that the Accidents of an immateriall thing should be mixed and confounded with those which belong to a materiall body, and this is the Reason why the Light of the Sunne is not mixed with the Light of a Candle.

That which they add of two Candles doth require an other Solution; for the Light of two Candles is of the same kind, but I utterly deny that they are not at all mingled, if this word *mingled* be rightly vnderstood for any mixture or confusion; for the Light of one Candle cannot be discerned from the Light of another but onely by their shadowes; and for this I refer you to your Senses for the tryall, because we treat of a sensible matter; for take two Candles and shew me the Light of the one and of the other, thou shewest the shadowes, and why? Because thou canst not discern the Lights one from another.

But the Reason why two shadowes doe appeare, is, because the Lucide bodies doe send forth their Lights by right Lines, and though their Light be mingled, yet they keepe the rectitude and straightnesse of their owne Lines. When therefore a darke place is opposite to two Lucide bodies, it is of necessitie that it send forth two shadowes, not that the shadow is formed of the Light, but because the darke place is illustrated onely in that part where-against the Lucide body doth directly shine, otherwise hindring the Light that it cannot reach vnto the backe thereof, which therefore casts an obscure shadow. So in the time of the Eclipse, when the Moone for want of Light seemeth to faint away & suffer a *Deliquium*, this hapneth because the Light of the Sunne cannot attaine vnto her according to his wonted manner, by reason of the interposition of the Earth betwixt them. For that obscuritie which is perceiued in the Moone is the shadow of the Earth; for if the shadow it selfe should proceed from the Light, then at Noone-day when the Horizon is perfectly illuminated there could be no shadow at all, because there is no reason why it should be made rather on the one part of the obscure body then on the other; nor why the Light should obscure or cast a shadow from one part of the darke body rather then from the other. But to the matter: I say that the cause why there remaine two shadowes, although the Lights doe mixe together, is the straightnesse of the Lines whereby the Light is sent from a Lucide or bright body into a darke, so that it alwayes leaueth the hind-part thereof darke whence the shadow commeth. And that this is true, it is hereby manifest, because the shadow is moued according to the motion of the Lucide body, as also after the motion of the darke body which casteth the shadow: So that alwayes there is a shadow at the backe-part, and that which lyeth opposite by a right Line against the Lucide body is alwayes enlightened. Yet these two shadowes will not be so obscure as if there were but one, because either of them is much illustrated by the Light of the other Lucide body by which it is not produced. And so much of the nature of Light.

QUEST. XXXI.

Of the difference betweene *Lux* and *Light* it selfe, and *Lumen* or *Illumination*.

Hose which doe peremptorily persist in the defence of the intentionall or imaginarie Essence of Light, hold that *Lumen* or the Illumination and enlightning is a *Species* or kind of that we call *Lux* or the *Light*. For, as the *Colour* and the *Species* doe differ in kind, so in like manner doth the Light it selfe differ from the *Lumen* or enlightning, because as Colours by their *Species* become sensible, so the Light is seene by the Illumination of it as by his *Species* or forme. But we consent not with them: For if Light were seene by Illumination, then this Illumination would not fall vnder the Sense; for the *Species* of sensible things are not themselves perceiued, but they are that whereby the Objects doe moue the Sense: Seeing then the *Lumen* is seene by it selfe, it cannot be that the Light should through it attaine vnto the Sense.

But they further obiect, that the *Lumen* or enlightning is in a Tralucient body, and the Light or *Lux* in a darke body, and that therefore they differ in *Specie* or in kind one from another.

But I answer that it is not so: Indeed we grant that the *Lumen* is in a Tralucient or bright body, but we confidently deny that the Light is in a darke body, for it is also in a Tralucient body, yet in a subiect more dense and darke then that of the *Lumen*, for the Light it selfe is more darke then the Illumination: Therefore saith *Aristotle*, it doth determine or limit the Sight, whence it hath the name of a *Colour*: For he calleth Light white in the Booke De

Answer to the second.

Why there be two shadowes of two Candles together.

The shadow is not from the Light but from the darke Body

The straightnesse of the Lines is the cause why there be two shadowes.

That they differ in kind.

This opinion improued.

Obiection.

Solution

Sensu & Sensili, and also in the fourth Chapter of his first Booke of *Meteors*, he calleth the Sunne white. But the matter is cleere of it selfe: For we perceiue that our Sight is terminated in a Flame, in the Sunne, or in the Moone, neither are any other Colours brought vnto vs through them.

Obiection, that
Lumen is not except

But it may be objected, that Light seemeth to be permanent and abiding in the Subiect, but the *Lumen* is not except in some cleare bright Body.

Answer

I answer, it is true: But yet this doth not argue a Specificall difference: for as the heat being proper vnto the Fire doth abide therein, and the other heat which is produced from this doth vanish when the Fire is removed from it, yet they differ not in kind, so neither doth *Lumen* or enlightning differ from *Lux* or the Fountaine of this Illumination.

That *Lux* and
Lumen do not
differ in kind.

But there be many Reasons why they doe not differ in kind one from another: for some time the *Lumen* or Illumination doth assume to it selfe the nature of *Lux* or Light: So the Moone hath Light which is manifestly nothing else but the very enlightning of the Sunne. But doe they not at all then differ? I say they differ: yet in the Planets not truly but onely in respect. For example: The Moone as it doth enlighten the Earth hath Light: But as it receiue this Light from the Sunne it is onely an Illumination: And hence it is that some Illumination hauing a conuenient darke Body opposed to it will become light and send an Illumination out of it selfe: But if you conceit it without a darke Body it will be onely an Illumination. Euen as the Elementarie Fire in his proper place is commonly called *Lumen* and yet is not seene because it hath no darke Body, that so it may transmit her Illumination to vs: So that Light is no other thing but a condensed Illumination, yet not so that it doth degenerate into a Colour.

Why the Ele-
mentarie Fire
is not seene.

Moreover, they differ in the subiect: for this *Lumen* or Illumination in his proper subiect is *Lux*, that is, a Light: but being without it, it is a meere Illumination, that is, Light is properly called that which is a Lucid or bright Body, as in the Sunne and in other Starres: but Illumination is that which is produced from the Light, so that in the Sunne there is not Illumination but Light, and in the Aire there is no Light but *Lumen* or Illumination onely.

QUEST. XXXII.

That Colour is the Object of Sight.

Colour is the
proper Object
of Sight.

Aristotles
Authoritie.



ALL Authors which euer writ of the Sight, haue determined with one consent, that Colour is the proper Object thereof, herein following the steps of *Aristotle* who hath beene their Leader and Guid: For in the beginning of the seuenth Chapter of the second Booke *De Anima*, he writeth on this manner: *That which is visible is Colour, and this Colour is that which is in it that is visible: And it is visible per se, or by it selfe, that is to say, It hath the cause within it selfe which makes it visible.* Where he not onely describeth the common Object of Sight, but doth presently after restraints it vnto a proper Object, to wit, that which hath the cause of visibilitie (if I may so say) in it selfe: But the cause of visibilitie is to be able to moue the *Perspicuum* or Tralucient body, that is, to imprint his Species in the *Perspicuum*, by the meanes whereof the Sight is moued, and therefore he addeth immediately these words: *All Colour is motiue, or able to moue that which is actually Tralucient, and this is the nature thereof.* If therefore the Colour doe by it selfe moue the Tralucid body, which is the proper cause of visibilitie, it must also be accounted necessarily for the proper Object of Sight: For neither Illumination, nor Light, nor any other thing by it selfe can moue this Sense, vnlesse in some part it be answerable vnto Colours, and then the effect is neuer the lesse due vnto the Colour.

Another
Reason to
proue it.

Add hereto, that the proper Object of Sight must be of that nature, that in it the Sight may be determined, and may there rest to informe the Visiue facultie, and wherein (if need require more accurate inspection) it may stay it selfe. But no such thing can be found in the whole Frame of Nature besides Colours.

Againe, by the Object of Sight all mixt Bodies doe become visible: But this is accomplished neither by Illumination, nor Light, nor by any other thing, but onely by Colours, and therefore they are the proper Object of Sight. It is true indeed, that things are made visible in the Light, yet not by the Light, that is, Light is no sufficient cause of Vision, because it is not able nor apt to moue the Tralucient body, but onely the forme of the *Perspicuum*, for when we say that Colour is able to moue the *Perspicuum*, we doe not vnderstand that

that it is the Act
to Colours alone
Lastly, all things
which are in the
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that it is the Act of it, but that it affects and moues it by a visive *Species*, and this is peculiar to Colours alone.

Lastly, all things which be visible doe fall vnder the Sight of the Eyes by the Accidents ^{3 Reason.} which are in them, after the same manner whereby we attaine to the knowledge of any thing by another qualitie: but neither Illumination, nor Light, nor any thing before mentioned is in visible things but onely Colour, therefore we know not things by them but by the Colour.

Seeing then that the Object of Sight ought to be such, that thereby we may come vnto the knowledge of visible things, none of these but onely Colour is to be accounted the Object of Sight, for this is in all things and doth immediately follow the Miftion of Elements.

I might add that in euerie Object there are diuers *Species* to be required, as contrarie, intermediate, and some alike, because there is no election, choyce or dignotion of one simple thing: But there are no differences of Illumination, nor Light, nor of those other things which we haue rehearsed, much lesse are there contrarieties: For Illumination doth not truly differ from Illumination, nor Light from Light; neither is Illumination contrarie to Illumination, nor Light to Light; but there are diuers differences of Colours, and one Colour is contrarie to another; not those therefore but this, to wit, Colour is the Object of Sight.

The variety of kinds is required in every thing.

QVEST. XXXIII.

Whether Colour be Light.

BECAUSE Light as well as Colour doth determine the Sight, and hath in it selfe a cause of visibilitie, hence some thinking that there ought to be but one Object of one knowing and discerning Facultie, haue esteemed Colour and Light to be of the same nature. But this cannot be, for all Colour is not Light, neither is all Light Colour; whereas if they had been of the same nature, they might haue been conuerted reciprocally.

Of one faculty must there bee one object.

But they vrge thus: *Euerie thing which is seene is Colour, but Light is seene, therefore Light is Colour.*

I answer, to be seene may be vnderstood two waies: First, commonly and improperly: so as euerie thing both Colour and that which is proportionable thereunto is said to be seene. And so Aristotle taketh it in the second Booke *De Anima*, and his Chapter *De Visu*, where in the beginning he saith, *That which is visible is Colour, and that which is without name:* As if he should say, *That which is proportionable vnto Colour.* And after this manner Light is seene, and yet is not therefore a Colour, because that on this manner many things may be seene which are not Colour, but onely proportionable vnto Colour.

Secondly, this word *Seeing* is taken properly: and according to this acception nothing can be seene besides Colours.

But they add yet further, that the same effect belongeth to the same cause; but whitenesse and Light doe performe the same effect, for a white Colour doth dissipate the Sight and wearie the Eyes, and the same effect doth the Light worke: Wherefore Light and a white Colour doth not differ.

Objections.

But we deny this Argument: For though there be great affinitie and likenesse betweene whitenesse and the Light, as also betwixt blacknesse and darknesse, yet no Identitie nor vnitie of the *Species* or kind doth hence ensue; for if the case were so, two Lucid bodies would produce Colours of two kinds in one and the same darke Body; because they can neuer shine equally and alike: but to shine were to send forth a Colour. Againe, when the Light fayleth, that is, when darknesse begins to come, first, a greene Colour, then a Purple, and so other intermixed Colours must be induced vpon the darke Body till at length it attaine vnto the quite contrarie Colour, to wit, Blacknesse; euen as the Light doth mediatly and by degrees degenerate into darknesse. But nothing can be more absurd then this: for we see that a white Colour remaineth white, vntill the least part of it may be seen, yea it abideth white till it be so darke that we can see nothing, and all Colours are taken away from our Eyes. Others with more shew of truth haue vndertaken to perswade that Colour is *Lumen* or an Illumination, which opinion they strengthen with no small Arguments. First, because when this Illumination is absent Colours cannot be present: and againe, at his arrivall or returne they are generated in the Bodies.

That colour is an illumination.

But this Argument is of small force, for *Lumen* or Illumination doth not generate Colours in bodyes; neither when it departeth doth it take them away, but is onely the cause wherefore they are sensible when it is present, and being absent are not seene. The reason is, because without this splendor Colours cannot mooue the Tralucēt body, and so the Night doth not take away the Colour, but the Images of it, which are as it were the *Deputies* or in stead of the Colours: but the reall Colours which are by themselves visible, doe remaine, if not actually, yet potentially.

Yet they vrge further, that we see by experience that the Clouds by the diuers irradiation or glittering of the Sunne some-time are of a white and some-time of a red Colour: as also is the Raine-Bow: for which cause also we see the Sea some-time to wax Purple colored, some-time to become gray, and a far off to shew white, and at hand blacke: Finally, the Neckes of Doves, and the Tayles of Peacocks doe wonderfully vary their Colours by the diuers aspect of the Light. But none of these are thus in deed and in truth, but doe so appeare by reason of the vehement splendor of this Sunne, or of the lenitie of the coloured body; whereupon the Sight is some-what hindred that it cannot discern of and know the reall Colours as they are.

Againe, this hapneth not onely from the direct or indirect irradiation of the Sunne, but also from our beholding of the coloured thing from on the right Hand or from on the left, forward or backward: For it is greatly to be respected whether the shadow of the coloured thing be on our side or on the opposite; and therefore according to the motion of the Peacocke so the Colour of her Traine seemeth to be varied: Which thing Painters when they goe about to Limne any Picture doe diligently obserue, marking the place wherein the *Life* is placed, to wit, in what part it doth receiue the Light. Moreouer, they consider the entrance into the place where it is, that they may resolue on what part they may best behold it: well knowing that not onely our Eye, but the Light also should be well disposed vnto the right perception and discerning of the reall Colour. For if a well-painted Picture be placed in an inconuenient place, his forme will not appeare artificiall, but deformed and disordered: not that it is so indeed, but that it onely appeareth so by reason of the inconuenience of the place. And thus also it is with the Colours of Peacocks, so that hence we are taught that the Illumination doth not alter the Colors, but the disordered scituation of the colored body and of him which beholdeth it are a great cause of the variation thereof.

QUEST. XXXIIII.

That the pure Elements are not coloured of themselves.



Perspicuum or Tralucēt body being without all darkenesse can neuer be so condensed that a Color should arise there-from, and therefore the simple Elements, yea and the Heauen it selfe haue absolutely no true Colour: for though the Aire may be so condensed that it may degenerate into Water, yet it will neuer attain vnto a Colour, no nor the Earth it selfe, nor yet that which is more condensed then the Earth. They therefore be in an Error which ascribe whitenesse vnto three Elements, and blacknesse vnto the Earth: Indeed Perspicuitie and Transparencie may be allowed to these three, and a kind of darkenesse to the Earth, but no Colour at all. Notwithstanding, they proue that Colours doe agree vnto the Elements, and especially simple Colours, as white and blacke; because they be simple, and as a mixt body is made of the mixture of the Elements, so say they from the mixtion of white and blacke mixt Colours are generated. And this is their Argument: *That which agreeth to any thing by participation, doth also agree to it by Essence; but both extreme Colours, and those which be intermixed doe agree vnto mixt bodyes by the participation of the Elements: whence they conclude, that it is necessarie that simple Colours, that is, white and blacke doe essentially agree vnto the Elements.*

To which we will answer by denying the Maior Proposition: For many things doe belong to a Body by the participation of another, which may not be attributed to that Body as it is absolutely considered. So to the Elements which are here with vs very turbulent and confused, many things doe agree, which no Man of vnderstanding dare assigne vnto the simple and sincere Elements.

As for example, our Fire which is nothing else but a certaine kindled and flaming smoke, is coloured, perspicuous and bright, but the Elementarie Fire we imagine to be pure and most subtle, from which as from a Fountaine ours doth flow, yet hath none of these grosse qualities

A good
observation
of Painters

The pure
Elements
are not truly
coloured.

Obiection.

Resolution.

qualities which our Fire hath: For being exceeding subtle and fine it hath no solid Substance admixed with it, and therefore is not affected with any Colour, neither is it Lucid and transparant: For Colour consisteth in such a body as doth determine the Sight, but Light doth not shine in a subtle and thin body, but in a dense or thicke body: We grant therefore for the present, that in mixt bodyes Colours doe result or arise out of the concurrence of the Elements, yet it doth not thence follow that Elements being pure & not defiled with the staine of other compounded matters should be rainted with such Colours as are said to be in the extremities of bodies, as Accidents are in the Subiects; because the second qualities arise from the first, which to ascribe to these simple bodyes were very erroneous: Wherefore the Elements doe not primarily generate Colours in mixt bodyes, but secondarily, that is, not as they retaine their proper nature, but as they lay it aside, and so doe conspire into the nature of the mixt body: For the Elements cannot concur in one & so make a mixt body vnlesse they suffer an alteration both according to their substance and according to their qualitie, and so they doe as it were put off their proper being or Essence, that by this mutuall embracing and coniunction they may produce a compound body. If therefore they neither retaine their substance nor their first qualities (which the Ancients esteemed as their essentiall formes) how should they referue entire to themselves those Colours which are their second qualities that the Colour of the mixt body should proceed from a confluence of the Colours of the simple Elements? Wherefore Colours doe belong to mixt bodyes primarily and by themselves, that is, Essentially and not by participation, and so we will passe by this Argument, not meddling with the Sophistry of their Syllogisme, which euerie one that runneth may perceiue.

How the Elements generate Colours.

QUEST. XXXV.

Of the generation of Colours and of their forme.

WE haue determined already, that true Colours are produced from the Elements mixt among themselves, and not from their first qualities, to wit, the heat, cold, humiditie and siccitie as some haue thought, though in deed almost all second qualities doe consist of these; but Colours doe arise from the Essentiall forme of the Elements, from which forme (as it were a proper Accident) they are deriued, that is; Colour doth arise out of the perspicuitie and opacitie of the Elements proportioned together: For three of the Elements be perspicuous, the Fire, the Aire, and the Water, yet so that the Fire is more transparant then the Aire, and the Aire then Water, onely the Earth is darke: When therefore the Earth is mingled with the three other, it doth determine their perspicuitie, and so induceth a Colour into the mixt body, for their transparency and perspicuitie is condensed and made more crasse and thicke, so that they cease to be tralucen and doe determine the Sight, and then Colour necessarily followeth. For to terminate the Sight in his Superficies is to be coloured, because nothing can determine the Sight but by some Colour: A Colour therefore ariseth from the condensation of a Transparant body by that which is darke in the mition of the Elements; for when the Transparant body by reason of the darke body ceaseth to be transparant, it becommeth coloured, and in his Superficies doth moue the Sight.

The original of Colours.

That which determines the Sight is coloured.

Hence appeareth their Error who suppose a double nature of Colour is signified in that definition which we haue giuen, seeing *Aristotle* calls it, *The extremitie or outside of the Transparant body*; for the extremitie of the Tralucen body is not a Colour, but that which like an Accident doth inhere in the extremitie or Superficies; or if you will, the extreme outside of the *Perspicuum* or Splendent body is not the cause of the Colour, but the Colour produced from elsewhere doth by his adumbration or circumscription determine the transparant Body: For the *Perspicuum* or Transparant body is that, which by reason of the tenuitie of his parts doth transmit the Light and so appeare, yet doth not determine the Sight; where therefore the Sight is determined, there the *Perspicuum* must end: For except it were so the Sight would yet proceed further beyond it; but the Sight is determinated onely by colour and therefore Colour is rightly called the rearme or bond and extremitie of the *Perspicuum*.

Colour is generated of the Mition of the darke body.

What Perspicuum is.

Many are of opinion, that there be no Colours in the darke but onely a kind of facultie and beginning whereof Colours do arise as it were out of a matter illustrated by illumination which serueth in stead of the Forme: Of which Sect *Epicurus* was, as *Laeticius* saith:

Of the forme of Colours.

Lucretius

*Præterea quoniam nequeunt sine luce colores
Esse, nisi in luce existunt primordia rerum.
Scire licet, quo sunt quævis velata colore?
Qualis enim cæcis poterit color esse tenebris?
Lumine qui mutatur in ipso: propterea quod
Recta aut obliqua percussus luce resulget.*

Again, because no Colour can without the Light appeare,
Who shall discern what coloured Maskes the Elements doe weare
Vnlesse the Light doe vnto him their seuerall hewes bewray?
And what Man can the Colours blaze which in blind darkenesse stay?
Because in Light all Colours change, and shine as they are smit
With the Oblique or direct Rayes which from the Light doe fir.

And he maintaineth his opinion by this, that as the coloured Body is illuminated either rightly or obliquely, euen so are the Colours thereof changed. But hauing disputed this before, I now passe it ouer, so that it remaineth that we demonstrate and shew that the *Lumen* or Splendency cannot be the forme of a Colour. But first let vs heare the Argument which the *Epicures* bring in defence of their opinion. They say therefore that *because the faculie of Seeing is one and simple, therefore all things which are indged thereby properly and by themselues, ought to be referred vnto one Primary Genus, and because Light cannot be reduced vnto Colour, it is necessarie that Colour be reduced vnto Light.*

The Epicures
Reasons
that Light is
the forme of
Colours.

But this Reason is so absurd, that it seemeth not worthy the time and labour of confutation, especially because it no whit aduanceth the certaintie of that which is in Controuersie. For they were to conclude, that *Lumen* was the forme of Colours, yet neuer the lesse, their Argument will not stand: for we grant indeed that that which is seene, ought properly and by it selfe to be reduced vnto one *Genus* or head, because the Facultie iudging of them is one as we haue proued before. But we deny that Illumination can properly be seene, or that Colour may be referred there-vnto. Haue we not conuincd by that which goeth before, that whatsoeuer is seene by it selfe is a Colour? Are not Light and Translucency perceiued improperly, to wit, onely as they are proportioned vnto a Colour, as we haue proued sufficiently? And haue we not demonstrated, that neither Light nor Splendency can be a Colour? How then shall Colour be brought vnto the nature of Light? Yea, I maintaine the contrarie, to wit, that Illumination may and ought to be reduced vnto Colour, because it becommeth visible no other way then as it obtaineth some proportion with Colour.

All the objects
of sight ought
to be reduced
to one head.

But in the meane time some doe object, That Colour is said to be actually the extremitie of the Transparent Body, that is, not of the Transparent body as it is Transparent, but as it is an illuminated Transparent body; because without Light both the Colour and Transparent body are onely in Potentia and possibilitie. Seeing therefore that the Light doth enduce an actual being vpon the Colour, it will follow, that Light is the forme of Colour, because the act of a thing is the forme of it.

Light is not
the forme.

How that of *Aristotle*, namely, That Colour is the extremitie of the Transparent body, is to be vnderstood, we haue shewed before: But where it is said, That Light doth actuate Colour, I answer, that Light doth not actuate the Colour as it is considered in it owne nature as a Colour, for a Colour remaineth a Colour euen in the darke: It is true indeed that it maketh the Colour actually visible, neither doe we deny it; but if it were the forme of the Colour it should not onely make it visible, but what Essence so euer Colour hath it should of necessity haue receiued it from the Light: But we haue taught already that the whole Essence of Colour proceedeth from the foure Elements.

The Reason
thereof.

Moreouer, it cannot be that this Light should be the forme of Colours. First, because the forme ioyned with the matter doe constitute one compounded body: But Light and Colours are in diuers subiects.

Again, who euer said that one Accident was the forme of another? But Light though it be some-thing more then a meere Accident, yet it fauours most of an Accident, and therefore cannot be the forme of a Colour.

Lastly, if Illumination were the forme of Colour, then Colours should not differ in *Species*, for whether the Light be strong or remisse, whether it be direct or refract and broken it is alwayes of the same *Species*, but we see that Colours be not onely diuers, but also contrarie, therefore Light cannot be the forme of Colours.

All difference
is taken from
the forme.

But the *Epicures* would make vs beleue, that this varietie of Colours proceedeth from their different originals and beginnings which they esteeme to be their matter. Surely, an opinion

opinion vnbeseeeming one which carrieth but the name of a Philosopher: For can you take the differences of things from their matter? Know you not that the Specificall difference of things doth flow from the forme? Is it any matter which distinguisheth a Man from a Beast? No: but the Vnderstanding or Reason. Now Reason is the forme of a Man, not his matter: And this we may learne by Mechanicall Arts, for the same Workeman out of the same matter doth forme both an Altar & an Image, and these differ one from the other, not because they consist of a diuers matter, but because a diuers forme is giuen to either of them.

To these we will add, that Colours are another thing then the Light. For Colours worke vpon the Light touching the Illuminated Aire, as may appeare in a Looking-Glasse receiuing Colours brought vnto it through enlightened Aire: So also the greenenesse of Trees and Medowes doth appeare in such Bodyes as are opposite vnto them, which could not be except the Colour should worke vpon the Light: But who euer said that the things formed did worke vpon the Forme?

How a Glasse receiueth Images.

QUEST. XXXVI.

Of the Medium or Meane of the Sight.

NO Man euer doubted whether the Sight stood in need of a *Meane*, but all rest vpon Experience, which no Man well in his wits will contradict: for if you lay any Colour vpon the Eye it will not be perceiued, and if that saying of Aristotle be true in any Sense, it is especially true in this Sense of Sight, to wit, that *the sensible thing being layd vpon the Sense doth make no Sensation*. Therefore we ought not to doubt that the Sight hath need of a *Medium*, especially being hereunto perswaded by Reasons besides Experience: For Sight is a spirituall Sense, and therefore cannot perceiue materiall things as they are materiall, but it discerneth their *Species* receiued in the *Meane*, & how could materiall things send forth these *Species* if there were no *Meane* betweene the Object and the Organ? I say, if there were not a *Medium* which might draw out and receiue the *Species* or Formes.

A visible object imposed on the Eyes is not scene.

The Reasons why it needeth a Medium.

It remaineth therefore that we make enquirie what that is which is a competent *Medium* in the Sense of Seeing. First, it cannot be a Body, for euerie Body is either Simple or Compound. A Compound body it cannot be, because all Compound bodyes be coloured, and by consequent are an *Object* and not a *Meane*; neither can any of the Simple bodyes be accounted for a *Meane*, for they be the foure Elements, Fire, Aire, Water and Earth.

No Body is the Meane of Sight. Neither Compound nor Simple.

Fire is no *Medium* for we can see without it, nor yet the Aire because we can see Objects which are in the Water, and this is the reason why the other Elements are not fit for this Function, for a true *Meane* must be in the midst between all visible things, but the Elements are not so, no nor the Heauen it selfe. It followes therefore that none of these may be accounted for the *Meane* of Sight.

It is therefore some Accident which we must resolute vpon to be this *Medium*, as appeareth by that which we haue said; and all Men doe with one consent acknowledge this Accident to be Perspicuity or Transparency, so that we need not to doubt thereof. But because this Transparency as it is an Abstract and an Accident is not sufficient for the performance of this Function, for that the Objects do require a certaine definite affection in the *Medium*, that so they may be carryed to the Instrument, whereby the consent and agreement may be preserved, and that there may be a Connexion and knitting of the Extreames, to wit, of the Object and Organ by the *Meane*: We must therefore find out what it is that doth assist and helpe this Perspicuitie. And this is nothing but the subiect of it, so that we doe not admit simply the Perspicuitie but the Perspicuous body at it is transparant for the true *Meane* of the Sight, that is, not the Abstract onely but the whole Concrete as it hath Perspicuitie in it, so that we are to consider in it both his Matter and his Forme.

Perspicuitie is the true Meane of Vision.

Not Perspicuitie but the Perspicuous body is the object of Sight.

The Matter of the Transparant Body is not one and the same, but diuers and manifold, I say, euerie thing which is peruious and may be perceiued without obstacle or resistance, for the *Perspicuum* seemeth to be deriued a *Perspiciendo* or perceiuing, as a transparant body a *Transparando*, because all things doe transpire and appeare through it. It is therefore nothing else but a kind of substance, not crasse nor dense, but thin, rare and subtile, and especially apt and fit to receiue Illumination and the Colours of other things, as are the Aire and Water, and also many other solid Bodyes, as Glasse, Ice, and such like, as the Philosopher witnesseth in the 68 Text of his second Booke *De Anima*.

The Etymon of Perspicuum

QUEST.

QUEST. XXXVII.

Whether Light be the Forme of that which is Perspicuous.

Whether the
Perspicuum
perish with
the Light.

WE haue taught before that Illumination is the Forme of the Perspicuous body, but because the Light doth very easily recede and goe away so that darknesse doth succeed and easily returne, it may worthily be called in question, whether at the departure of the Light the Perspicuous body doth also perish and cease to be, and is againe generated with the returne of the Light or Illumination.

The Perspicuum
is potenti-
all in the dark.

For my own part that I may speake ingenuously, I am perswaded that it is not corrupted wholly, but onely after a sort seemeth to perish, for whatsoeuer is deprived of his essentiall forme is said to perish. It seemeth therefore that the Perspicuous body may be said to perish when at the receding of the Light darknesse doth ensue: which darknesse is a priuation of that Light which was the Essentiall forme of the *Perspicuum*, I speake of a body actually Perspicuous, because the action, or if I may so say, the actualitie of it ceaseth when the Light fadeth, yet notwithstanding it remaineth in *Potentia* or in possibilitie: for the enlightning doth not induce any subtiltie or tenuitie of the substance: and whatsoeuer is thus perspicuous is also potentially perspicuous in the very darke, for sometimes Darknesse sometimes Light are in Perspicuous bodies, as *Aristotle* saith in the 69 Text of the second Booke *De Anima*, where he defineth a Potentiall perspicuous body.

A doubt
resolved.

But there is yet another doubt of greater weight: For because the Light is an Accident, to wit, a qualitie proceeding from the Lucid body, how can it be the Forme of the Perspicuous body? For to be a Forme of any thing is peculiar to a Substance, how then can that give any Essence or being to another which hath no Essence at all of it owne? For the Light hath no being of it selfe but doth perpetually depend vpon the Lucid body, & therefore how should it give an Essence to the *Perspicuum*? I grant indeed that the Light may be called a qualitie of a Lucid body, yet I deny that it is nothing but a meere Accident: For all Accidents haue their being in some Subiect, and out of the same are nothing: But *Illumination*, though it doe depend perpetually vpon some Lucid body, yet it doth exist out of it, and doth onely in respect differ from that *Lux*, which is as it were the Fountaine of it, as before we haue shewed, and we see that this Illumination is diffused through the whole Hemisphere, which could not be if it were a meere Accident, and had no proper Essence of it owne, for no Accident doth spread so farre from his Originall or Subiect.

Answer

The Essence
of an accident
is in another.
Light is not a
meere accident

We say therefore that *Lumen* out of the Lucid body hath a certaine proper being of his owne, and in that regard is said to be the Forme of the *Perspicuum* or Transparant body, for which cause some call it, *The imitation or resemblance of a Lucid body in a perspicuous Medium*. But as it is in the Lucid body and doth depend vpon it as vpon his originall, it is not without some reason called a qualitie of the same Lucid body.

How the
Light is a
qualitie

Objection.

But some argue against this on this manner: That the Light cannot be the Forme of the *Perspicuum*, because it also receiveth the darknesse into it: If therefore Illumination be the Forme of it, then that which is contrarie vnto it, to wit, darknesse, would in like manner supply the place of a Forme, and so one thing would haue two Formes.

Solution.

But the consequence is false, for though the Perspicuous body doth receiue as well darknesse as Light, yet not after the same manner; for it receiues the one as his Forme, the other as the priuation of that Forme; Light as his Act, and Darknesse as the priuation of that Act. For Darknesse is not contrarie to Light, but a priuation of it, and indeed no other thing but an absence of Light from a Subiect which is fit for Illumination.

What darke-
nesse isAucens
opinion.

But *Aucens* saith, that the Light is not receiued in a Perspicuous but in a darke body and coloured, which body when it is outwardly illustrated, then he thinks that the Perspicuous body is illuminated, and he would haue this Perspicuitie to note nothing else but a priuation of that which hinders the Light, and then that *Perspicuum* is present when there is nothing to hinder the Colour that it might not be illuminated. If then the Light be not receiued in the Perspicuous body, it cannot by any meanes be the Forme thereof.

Refuted.

But though there be many learned Men of this opinion, yet I cannot stay my Iudgment vpon it for some perswasible Reasons which moue me to thinke contrarie. For nothing can passe from one extreame vnto another, vnlesse it passe by the *Meane* which is betwixt them; and it cannot passe through the *Medium* vnlesse it be first receiued into it. Moreouer in a perspicuous *Meane* there appeare diuers effects of Light; for it is attenuated and heated,

heated, which could not be if the Light were not first receiued into it. And by this we may easily gather the insufficiency of *Anicent* conceit. Thus much concerning the difficulties about the Eyes: Now let vs come to the Sense of Hearing.

QUEST. XXXVIII.

Of the Production of a Sound.

Aristotle in the first Chapter of the fourth Booke, and in the sixth Chapter of the sixth Booke of his *Topicks*, saith, That the knowledge we haue of any *Species* dependeth vpon the knowledge of the *Genus*. Seeing therefore that the Voyce is a certaine *Species* of Sound, and as it were an Of-spring propagated there-from, it must needs be that it fauour much of his originall and beginning. Wherefore before we come vnto the knowledge of a Voyce, which is the most particular Object of the Sense of Hearing, it is very necessarie that we premise some-what concerning the Production of a Sound in generall, for by that meanes our knowledge of this Action of the Soule, I meane the Sense of Hearing, will be better guided and perfected.

Why the production of a Sound must goe before the definition.

Wherefore we will first shew you the manner of the Production of a Sound. Secondly, the definition of a Sound. Thirdly, the differences of Sounds. And lastly, we will vnfold some difficulties which may other wise breed scruple in vs. I know well that in other things the plainest way of teaching is to begin with a definition, but because a Sound is, as we say *ens fluxum*, that is, such a *being* as is then onely existent while it is a doing and in the time of his generation, it must needs follow, that when the generation or manner of production is sufficiently knowne, the nature and definition will be better vnderstood. Hence it was that *Aristotle*, when he would deliuer the nature of a Sound, began his Treatise at the manner of Production, and so will we, insisting in his Foot-steps, which although we cannot attaine vnto, yet we will as farre off adore.

As therefore no Sound is made without two Bodyes mutually impeaching or offending one against another, as euen our Sight and Hearing doe sufficiently teach vs, so our Minds also may conceiue, that without the mediation of a third thing, which should be not onely the *Medium* wherein a Concussion is made, but also the materiall cause hauing in it a *Power* of sounding materially, there can no Sound at all by the Concussion of those Bodyes be produced.

Two Bodyes.

Three things required to the production of a Sound

The necessitie of this *Medium* or third Body which must come between in the Collission of two hard Bodyes which make a Sound may be thus demonstrated. If two Bodyes meet one of them must moue and apply vnto the other. Now we know that motion cannot be made without a *Medium*. Againe, that this *Medium* or third Body must haue the facultie of sounding materially therein, is proued, because though two Bodyes offend one against another, yet if they be sharpe or soft they make little or no Sound at all: so a Needle against a Needle, Wooll against Wooll doe not sound. The reason of the first is, because there is no quantitie of this intermediate matter to make an Impression of: The second, because though there be a Collission yet there is no resistance.

A Medium.

Moreover, things that are vnequall or rugged doe not sound well, neither doth a plaine thing make a full sound: For the more cauitie there is in the Body that is beaten (so it be proportionable to the violence that is offered) the more resonant is the Sound. Add hereto, that some-times though the Collission be with greater violence, yet the Sound is not so loud: for two Blockes beaten together will not make so loud a Sound as a little Bell; and when a new piece of Cloath is torne asunder, the rash is louder then if two harder Bodyes should enterfaire one against another. All these instances doe manifestly proue that there is a third thing requisite vnto the production of a Sound, which is also the matter thereof. This third intermediate Body is that wherein the Concussion is made, be it Aire, or Water or Fire: For those three be not onely fit for the Transuection of Sound, but haue also in them the matter whereof it is formed, although not in an equall degree. In Concussions therefore the Facultie of the *Medium* or power of the Matter is actuated when it is intercepted and broken betweene two Bodyes offending one against another.

Many instances to proue that there must be a Medium.

The manner of this interception or fraction is thus: when two Bodyes strike one against another, that which is betwixt them is so vehemently driuen, that one part of it cannot orderly moue by succession after another, but rather one part preuents another, and before the first part hath parted from the place, another is driuen vpon the Necke of it, and so the motion which when it is successively made, is gentle and easie, becommeth now by reason

The manner of the fraction.

of

According to
the differences
of the former
instances.

of this inordinate violence tumultuarie and troublesome. Hence it is that soft and acute Bodies make no sound in their Collision, because the stroke that is betwixt them doth not so dispartle or diuide the intermediate Body that there should follow vpon it any interception or fraction, whereby the successiue dissipation may be preuented. Vnequall bodies because in their depressed parts they diuide the Aire as it were into parcels doe yeeld a lesser Sound. Those that are hollow because they gather and close more Aire which is confusedly shuffled and beaten part vpon part, doe yeeld a greater and stronger resonance. Two Blockes beaten one against another doe not sound so loud, because the fraction is not so smart. A Bell and a Clapper because of their hardnesse and polished Superficies doe breake the Aire more suddainly and thoroughly, and so beget a louder and brisker Sound. A new Cloath when it is torne a sunder raseth louder then the percussio of a harder Body, because the Aire which is about it is diuersly distracted into many parts where the many Threds are torne a sunder.

It remaineth therefore that a Sound is made when as two Bodyes offending or iustling one against another, the *Medium* wherein they are moued endureth betwixt them a compression, that compression endeth in attrition, that attrition in fraction, and that fraction kindleth as it were at resonance.

That the fraction
is not
the sound.

Wherefore *Aristotle* said well in the 78 Text of his second Booke *De Anima*, that a Sound is alwayes actuated *when one thing moues against another in a third.*

But although the Aire thus beaten and broken makes a Sound, yet the very fraction of the Aire is not the Sound, neither the next and immediate generation thereof, and herein all Philosophers doe agree, particularly *Auicen*. But what shall we stand vpon Authorities? We proue it thus:

Not the motion.

The Fraction of the Aire is a motion, but the Sound is not a motion: First, because a Sound is the proper Obiect of the Sense of Hearing, but Motion is a common Obiect not discerned by the Sense of Hearing, and therefore a Sound is not a Motion.

Secondly, Motion is no qualitie but reduced vnto other *Predicaments* as we say in Schooles, that is, to *Action*, *Passion*, or *Place*: but Sound is a qualitie, to wit, one of the third kind to which the Obiects of the Senses are referred.

Thirdly, Sound is made by Motion; so we see by Experience; so we are taught by all Philosophy; the same Philosophy teacheth vs, *That nothing produceth it selfe.* Seeing then that Motion produceth Sound, certainly Sound can be no Motion.

Objection.
Solution.

It may be objected that *Aristotle* in the 58 Text of his Booke *De Sensu & Sensili*, and the sixth Chapter saith, that Sound is a Motion. But we answer, that he speaketh not in a formal Sense but a casual, that is, not endeavouring to giue the definition of a Sound, but a casual production, as if he should say, When some Motion is made with such and such circumstances, a Sound will result there-from.

Aristotle's instance.

We will also add another Reason and that very strong, which is on this manner: Those things which haue a particular existence or being one without the other, are in themselves feuerally distinct and diuers. Now the Sound and the breaking motion of the Aire haue feuerall and particular beings, because the Sound is diffused and attaineth to those parts of the Aire or Water, to which parts the Motion cannot reach. And this *Aristotle* in his fourth Booke *De Historia Animalium* proueth by the example of Anglers, who in the time of their disport are as silent as may be, and yet the Fishes heare them. Now saith *Aristotle*, it is not like that their whisperings can produce so vehement a motion that the parts of the Aire broken thereby should by succession moue thorough the whole masse of Water vnto the Sense of the Fish.

That sound is
not immediately
generated
by motion.

Again, that this fraction of the Aire is not the next and immediate generation of the Sound, may thus be euicted: Locall motion of it selfe contendeth or striueth onely vnto *Place*, neither of it selfe doth it make impressio of any other reall *Being*, sauing vpon that which is moued, as *Aristotle* teacheth in the eighth Booke of his *Physicks*, the seventh Chapter and the 59 Text. It followeth therefore, that the generation of Sound is another action besides the motion, which action I know not how to name; yet we may well conceiue a difference betweene the locall impulsio and the Sound, as we may also perceiue that besides locall motion some times heat is engendred, yet no Man will say that motion is the immediate cause of heat. After this manner also we may well conceiue how the influences of the Starres may be dispensed in this inferiour World.

To conclude therefore, it is manifest that there must concur three actions to the production

duction of any Sound, and these three doe each accompanie and succeed other. The first action is the affront which is betwixt the two Bodies which offend one against another. The second is the fraction or breaking of the *Medium*. The third and last is the resonance of that *Medium*, for so you shall giue vs leaue to call it, because we can deuise no other name.

Immediately after this followeth the Sound.

QUEST. XXXIX.

The definition of a Sound.

Having as plainly as we could delivered the manner of the generation and production of a Sound we will now briefly set downe the definition of it. *Aristotle* in the 65 Text of his second Booke *De Anima*, defines a Sound to be a motion of that which may be moued with that motion where-with those things are moued which doe rebound from the mutuall percussio of two Bodies. Others doe define it to be a Sensative quality striking the Hearing and the proper Object of that Sense. But we will thus define it, A Sound is a passie and successiue qualitie produced from the interception and breaking of the Aire or Water which followeth upon the collision or striking of two sounding Bodies, and so fit to moue the Sense of Hearing. If any should object, that there is but one onely nature of one thing, as *Aristotle* saith in the fourth Chapter of his first Booke of *Topickes*, and that a definition is an oration expressing the nature of a thing, as the same *Aristotle* in the fifth Chapter of his first Booke and the sixth Chapter of his fifth Booke of *Topickes* saith, There can be but one definition giuen of one and the same thing. And therefore a Sound should not consist of one Simple, but of a three-fold Nature, because we haue set downe three definitions one differing from another, whereas we promised but one definition in the Title of this Chapter. It is therefore to be considered, that three things may be obserued in all Accidents, and from the knowledge of these their Nature may be better manifested: These are the *Subiect*, the *Genus* and the *Cause*: By which three according to the diuers intention and end of the Definer such Accidents are defined either with the mention of them all, or of the *Subiect* and *Genus* onely the *Cause* being left out, or of the *Cause* alone omitting the other two. The first manner of defining satisfies the Vnderstanding best, the other affords but a lame and defective Vnderstanding of that which is defined.

So in this definition of the Eclipse, that it is a priuation of the Light in the Moone by reason of the interposition of the Earth betwixt the Moone and the Sunne, all three are contained.

Likewise the Thunder defined to be a Sound in a Cloud made by the extinction of Fire, is a definition consisting of all three: But this Thunder is onely defined by the *Subiect* and the *Genus*, if we say, that Thunder is a Sound in a Cloud, and by the *Cause* alone when we say, It is an extinction of the Fire. Now if the nature of Accidents be such, and so great varietie be in their definitions, there is no reason but that a Sound may be described some times one way, and some times another, to wit, either perfectly or imperfectly.

Again, what hindreth that one and the same thing may not some times be defined absolutely, some time relatively, the nature of it being as it were changed vnder the same name or appellation, as it hapneth to a Sound here. It remaineth therefore that there is but one definition of one thing: but if there be more, there is but one perfect and absolute, or else they be all imperfect and defective. Again, one definition is conceived or written absolutely, another relatively.

Let it not then seeme strange to any man that one and the same thing according to a diuers acception thereof, is by *Aristotle* diuersly defined; as also in the first Booke *De Anima*, he defines *Anger* to be an appetite of Reuenge: and presently after, that it is a Feruour or boyling of the Blood about the Heart. Again, he describes a House to be a couer and shelter to defend vs from the violence of Winds and Showres, and also he defines it to be a Worke or Building made of Clay, Stone and Wood: Euen so here when he describes a Sound to be a percussio of one Body against another, it is not formally defined, but by the Efficient cause: so we say, the Eclipse is an interposition of the Earth, that is caused by the interposition of the Earth.

Others defining a Sound say, It is a passie qualitie striking the Sense of Hearing. But we haue added a third (saith *Placentinus*) which notwithstanding I will not discourse of so fully as he hath done, because many things will fall into the following Controuersies.

QUEST.

The definition of a Sound

Objection

A three-fold definition of Accidents.

By the Eclipse

And Thunder

One absolute definition of one accident.

QUEST. XL.

Of the differences of Sounds.

WE desire to know when we treat of any Subject, first, what it is: and then how manifold it is: Wherefore hauing set downe the true definition of a Sound, we will now speake of the differences thereof, which differences because they be drawne from diuers Fountaines and Originals, they are therefore as diuers and manifold.

The difference
of a Sound
from the
Essence,
Graue.

First in respect of their Essence they are thus distinguished: Some Sounds continue long, others endure but a while. Both of these may be thus subdiuided: The first doth either by his long continuance much moue the Sense, or else but a little; and this is called a Graue, Base, or an obtuse Sound. But that which is of a small continuance is diuided into that which either in this short continuance doth greatly moue the Sense, or in the same time doth moue it verie little; and this is called an Acute or trebble Sound, and it is opposite to a Graue or base Sound. And both these haue borrowed their names from tactile qualities which doe properly challenge these names to themselves. An acute Sound hath his name from a sharpe or acute heat or cold; for as these qualities doe easily penetrate any Body, so this acute Sound the Sense of Hearing, which in a short time causeth much Sensation. An obtuse Sound hath his name from obtuse or dull heat and cold, because it doth much resemble them.

Acute.

Obtuse.

And by these may be gathered a manifest difference betwixt a Sound and the Objects of other Senses, for they all doe remaine in the sensible things when the Sensation is past, in which things they actually exist both before and after Sensation, but the Sound doth vanish and goe to nothing, together with the perception thereof. And hence it was that *Aristotle* said, *Some sounding things were onely in Potentia or in Power, and others in Act, &c.*

The Echo

Againe, in respect of the Essence some Sounds are direct, others Reflected, which is called an Echo.

Different
Sounds from
the Essence.

According to their existence some Sounds be in power and possibilitie, others in act.

The formall and inhesiue subiect of potentiall Sounds is in the Aire and Water, but the subiect of an actuall Sound is Iron, Brasse, Siluer, Gold, Stones, Wood, and other hard and smooth Bodyes. And hence doth arise another especiall difference betwixt a Sound & the objects of other Senses, for these do inhere in the Sensible things actually and subiectiuelly, both before, in, and after Sensation: but a Sound doth not exist in any sensible thing actually and subiectiuelly, neither before, nor after, nor yet in the very perception of the same.

Manner of
production

Againe, in respect of the manner of their production: Some Sounds are made by the fraction of the Aire caused by two solid Bodyes, and these Bodyes because they concur vnto the making of a Sound, being distinct either in deed or in some respect, according to their diuers and manifold concursion this kind of Sound is againe distinguished.

The Sound of
Wind.

Some are made by Allision, as when the Aire moued by a vehement Wind doth beat against a solid Body, and of this kind is the Sound when the Lungs doe deliuer ouer the Aire or breath vnto the hard parts of the Rough arterie which maketh a kind of wheezing or whistling.

There ariseth also another kind of Sound when the Aire beateth against other Aire, as it is when the Wind is high, for at such time in the open Fields a Man shall heare a whistling noyse.

Of Cloath

There is another kind of Sound ryfing from Coition: Coition I meane or coniunction of the Aire as when Cloath or Paper is torne, for then to auoyd vacuities the parts of the Aire doe suddainly conioyne at the sides of the Cloath or Paper, where the first parts that are driuen are broken by those which follow and so make a Sound.

Hissing.

There is another kind of Sound made by extention of the Aire, as when in hissing it is driuen thorough the Teeth.

Finally, another by Constriction as in a Pipe or a payre of Bellows, or in Holes or Caues of the Earth where-into the Wind driueth the Aire, and when it is in, sholdreth it as it were into a corner.

Naturall
Sounds

The differences of Sound in respect of the Resonant bodyes are double according to the differences of those Bodyes, to wit, one Naturall, the other Violent. I call that Naturall which is made by such Bodyes as are able from a principle within themselves to make an impression, or to giue a stroke. And this Sound is againe double: The first belongeth to

Animated

animated bodies, the second to those that haue no life. That of animated bodyes is a sound produced willingly by the moouing faculty of the Soule. And it is againe double, that is, made by such organs as are by Nature principally deputed for the production of sounds, or by such organs as are not to that end appointed: The first kinde is yet againe double, One formed by the *Glottis* of expired ayre and is called a *voce*, the other is made of ayre which is not receiued by Respiration, nor formed by the *Glottis*, but by the action of some other body. And of this kinde is the sound of those creatures which wee call *Insecta* and of most Fishes. The Sound that proceedeth from such organs as are not thereto by Nature deputed is also double. First, as when two creatures or two hands do strike one against another, the second when one body hath life, the other hath none, as when a man strikes his hand vpon a Table.

The Voce.

Furthermore, the naturall Sound of bodies without life, is that which is made by the action of the first qualities, as that of the Fire, of the Ayre, of the Water, of the Earth or of these mixed: for example, the thundering of Aire when it is concluded or shut vp in water and violently breaketh forth through a narrow outlet. And thus much of Naturall Sounds. I call that Violent which is made by bodies beaten one against another by an extrinsecall or outward principall, all which might bee nicely parted into seuerall Sections if wee did not thinke that any man might out of the order wee haue before insisted vpon frame vnto himselfe a multitude of distinctions or differences of Sounds.

Violent
sounds

QUEST. XLI.

Of the manner of Hearing.

Concerning the manner of Hearing the Philosophers doe diuersly dissent in their opinions.

Diuers opinions
of hearing.

Alcmaeon thought that wee did therefore Heare because our Eares are empty and hollow within, for all empty things doe make a resonance.

Diogenes.

Diogenes thought that there was a kinde of Ayre within the Braine, and that this Ayre was stricken with the voyce, and this conceit was controuerted in *Hippocrates* times, and therefore in his booke *πρωτον*, he inueigheth against it, *There are* (saith he) *some which writing of the Nature of things haue affirmed that the braine doth make a sound, which cannot be, for the Braine is humid and moist, but no moist body can cause a sound.* *Plato* writeth that Hearing is made by the pulsation and beating of an internall Ayre.

Plato.

But wee passing by these slippery wayes of opinions will insist vpon the true manner of Hearing, and in a short and familiar discourse display the whole Nature thereof. For because the Organ of Hearing was vknowne to the ancient Philosophers and Physitions, particularly to *Aristotle* and *Galen* in whose dayes Anatomy was but in the infancie, and therefore the many small and curious parts of that Organ not found out, we cannot therefore collect the perfect nature of Hearing out of their writings, and therefore in this disquisition wee must trust more vnto our owne experience.

Aristotle in his second booke *de anima* and in his booke *de sensu & sensibilibus*, saith, that three things are required vnto sense.

How hearing
is made.

The object, medium and instrument or Organ; the object of the Hearing is Sound, as colour is the object of the light, but of the Nature of a sound, we haue intreated already as much as is necessary for this place. Onely I will call to your remembrance by the way, that a Sound is a quality arising from the fraction and breaking of the Ayre which is made by the percussion of two hard and solide bodyes, for soft things doe easily yeeld, neither doe they resist the force of that which beates against them.

The object of
it.

What sound,

The medium or meane of Hearing is the externall Ayre, for *Aristotle* doubted whether a voyce could be heard in the water or no, and yet he knows very well that Fishes do heare who was euer present at the fishing for Mullers in the night.

The medium
of it.
The Organ of
it.

The instrument of the Hearing is not the externall Eare, but the internall, which consisteth of foure caviities and many other particles vknowne to the Ancients.

The manner therefore of Hearing is thus. The externall Ayre being stricken by two hard and solide bodyes, and affected with the qualitie of a sound doth alter that Ayre which adioyneth next vnto it, and this Ayre mooueth the next to that, vntill by this continuation and successiue motion it arriue at the Eare. For euen as if you cast a stone into a pond there will circles bubble vp one ouertaking and moouing another: so it is in the per-

The manner
of hearing.

cussion of the Ayre; there are as it were certaine circles generated, vntill by succession they attaine vnto the Organ of Hearing. *Auicen* very wittily calleth this continuation of the stricken Ayre *vndant vocalem*, a *vocall waue*. But this kind of motion is not made in a moment but in succession of Time, wherevpon it is that sound is not presently after the stroke heard from afarre.

The Ayre endowed with the quality of a sound is through the auditory passage, which outwardly is alwayes open, first stricken against the most dry and sounding membrane which is therefore called *Tympanum* or the *Drumme*. The membrane being stricken doth mooue the three little bones, and in a moment maketh impression of the character of the sound. This sound is presently receiued of the inbred Ayre, which it carryeth through the windowes of the stony stone before described, into the winding burroughs, and so into the Labyrinth, after into the Snaile-shell, and lastly into the Auditory Nerue which conueyeth it thence vnto the common Sense as vnto his Censor and Iudge. And this is the true manner of hearing.

QUEST. XLII.

whether the proper and inbred Ayre contained within the Eare be the primary and principall Instrument of Hearing.



HE proper and ingenit ayre which the Barbarians call *Implanted*, and *Aristotle* *inadificated* and *immoneable*, is contained in the second cavity of the Eares, which the same *Aristotle* calleth the *Snaile-shell*. Some doe call it *Immoneable*, because it is not mooued by any other, but alwaies remains the same in the Eares. Others call it *immoneable*, because it hath no naturall sound, but can receiue all the differences of Soundes. The ancients thought that this ayre was the chiefe and principall organ of Hearing, and in respect of this ayre *Aristotle* in his second booke *de anima*, and in his booke *de Sensu et Sensil.* saith, the nature of the Hearing is ayry.

Indeede I esteeme this Ayre to be very necessary vnto Hearing, yea so necessary that Hearing can scarcely be performed without it: but I can neuer perswade my selfe that it is the principall organ of Hearing. It is an vniuersall Theoreme and generally true, that in euery perfect organ there is some certaine particle to which as to the chiefe cause the Action is to bee attributed; so in the Liuer the *vagus nervus* maketh Sanguification, In the Eye the Christaline humour causeth Sight, in the muscles, flesh effecteth motion, and the Mammillary processes doe make the smell. But it will be objected, that this inbred ayre is not a Similar part, therefore no such Action is due to it.

Now that it is no part may be thus demonstrated. Euery Similar part is either Spermaticall or fleshie, but this ayre neither deriueh his Originall from the seede nor from the blood; therefore it is no part. If it bee answered, that it is not indeede a simple ayre but a kinde of spirit. I againe reply, that it cannot be a spirit; for if you conceiue it to bee a vitall spirit, it should not forsake the Arteries: If you say it is Animall, then should it follow that an animall spirit should bee accounted the chiefe instrument in the organs of the other Senses.

Againe, a spirit is the most common organ of the Soule, which that noble forme vseth vnto the performance of all her functions. But as there is a peculiar part in the eye which doth primarily cause vision, to wit, the Christaline humor, a Similar and Spermaticall part generated of the purest portion of the seede: so there must be such a Similar part found in the Eare. But such is not that ingenit or inbred ayre, because it differeth nothing from the outward ayre, but onely in purity and rest. It is generated of the outward ayre, not indeed by coction and elaboration, as are the spirits, nor yet by any action of the Soule, but by the continuall arriuall of new ayre, which partly is brought thorough the hole of the Eares, being alwayes open and winding vnto this Cochlea or Snaile-shell; partly deriued thither, by inspiration thorough a certaine little hole or pipe like a *water-course* opening into the palate.

Moreouer, wee may out of *Aristotle* in the second booke *de Anima*, proue that nothing without life can be the instrument of any Sense: but the inbred ayre is without life or soule, because the Soule is not an act of a simple body. Neither hath this inbred ayre any organs of a soule, for why should this ayre which is only generated by the outward ayre, not concocted by any faculty of the Soule, be rather animated then that ayre which

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of is.

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is in the other cavities of the body. But this Ayre doth *rest* in the Eare, and not in other cavities; because it is concluded in a strait hole; and by reason of the windings of these darke labyrinths cannot easily passe forth.

It is not therefore the organ of Hearing; but rather an internall *Medium*. For as the outward ayre is stricken by the beating of two bodies together, so is the internall stricken by the externall; & that by the interiection of the Tympane, or Drumme, of the Chord or string, and of the three little bones. The same ayre being altered, doth carrie the bare Character and *species* of the Sound separated from the matter, to a nerue of the fifth coniugation, led along and dilated in each Eare. And this nerue is the chiefe organ of Hearing, as the mammillary processes are of the Smell.

It is an internall *Medium*.

Now that this internall *Medium* is required in every Sense, may bee demonstrated by example, for the watery humor is the internall *Medium* of the Sight, the spittle of the Taft, the cuticle or scarfe-skin of the Touch, and the spongie bones of the Smell. In all which the formes are separated from their matter, and being so separated are conuayed to the principall *dispositio* or Organ, that is, the Christalline for the Sight, the Pulpe of the Tongue for the Taft, the Mamillarie processes for the Smell, the true skin for the Touch, and so the Auditorie nerue for the Hearing.

The internall *medium* of all the Senses.

QUEST. XLIII.

An explication of certaine hard Problemes about the Eares.

IT remaineth that wee proceede vnto the dilucidation of some difficult questions concerning the Eares, which knots wee will vntye and explaine for a conclusion of these controuersies. The first thing propounded is, How it comes to passe that *wee are more recreated with Hearing then with Reading*: For wee are wonderfully delighted in the hearing of fables and playes acted vpon a Stage, much more then if wee learned them out of written bookes. *Cardan*, as *Scaliger* saith in his 308 *Exercitation*, contentes himselfe with this onely reason, because, saith hee, those things which are published in bookes are made vulgar and common, and therefore are not so curiously nor with so much delight read ouer; but good Actors are more rare.

Why Hearing in more delightfull then reading

Cardanus.

Scaliger refuteth this argument, both because good bookes are as rare as good Actors, as also because it is not the part of a humane ingenuous disposition but of a liuid and malicious minde, to esteeme those things most precious or more pleasant which are vnknowne to others.

Disproued by Scaliger.

Scaliger therefore presenteth many other reasons of this Probleme. First, because wee learne those things which wee heare with lesse labour then those things which we read.

His reasons.

Secondly, because a voyce doth more affect vs by reason of his inflexion and insinuation into our Sense, whereas reading is onely a dumbe Actor.

Thirdly, because those things which be heard, take a deeper impression in our minds, which is made by the appulsion or ariuall of a reall voyce. But those things which are seene are alwayes intentionally imprinted, and therefore the Act of Seeing is sooner ended and passeth more lightly by the Sense then the Act of Hearing. Whence it followes necessarily that things seene do not sticke so fast vnto vs. And this the Apostle insinuateth when he saith, *Hee beholdeth his face in a glasse and geeth away, and presently forgetteth what manner of one hee was*. Neither is that of the Lyrick Poet any sufficient contradiction of this where he saith:

Segnius irritant animos admissa per aures,

Quam qua sunt oculis subiecta fidelibus.

The voyce that sinkes in by the eare doth not so soone offend

Or gall the minde; as when the eyes more faithfull message send.

For that is true of those things which we doe onely beleue by heare-say, which indeed doe not so neerely affect vs as those things we see done before our eyes.

The fourth reason is, because there is a kinde of society in narration and acting, which is very agreeable to the nature of man, but reading is more solitary.

Fifthly, because a certaine shamefastnesse and obseruancie doth cause vs to apply our eares to him that vttereth any thing by voyce, but in reading there is a kinde of remission in the minde and security from any blame of not profiting. Now wee conceiue more pleasure in a diligent and curious acting, then in a negligent and carelesse.

Sixtly, wee haue opportunity to demaund a reason of some doubts from him which speaketh to vs; and thence we receiue more profit then by bare reading, from which profit a certaine delight doth arise. Againe, because Bookes cannot digresse from their discourse for the better explication of a thing, as those may which teach by their voyce. For in changing of words or mutuall conference, many pleasant passages are brought in by accident, as the Interlocuters list to aduance themselves; as wee see in Comedies it is very ordinary. And by these fauces, as it were, of discourse, is the Hearing more sumptuously feasted, but the vniformity of the stile in things written and the continuity of the sentences causeth the Reader to loathe it.

A second
question.

The second question is, why a mans voyce which is sweeter then the sound of a Pipe, is yet not iudged sweeter by the Eare if a man imitate the sound of a Pipe with his voyce; for when a man sings his voyce is sweeter then a Pipe, but a pipe is more pleasant then a mans voyce when hee whistleth.

Resolution

Some resolve this probleme thus, that it so hapneth because that which is naturall is more pleasant then that which is counterfeited and fained. And therefore when a man sings hee addeth an articulation to his voyce about the sound of a Pipe; wherefore it is not strange that it is iudged to bee sweeter; but when hee imitateth a Pipe or whistleth, it doth not sound so pleasantly as a pipe because hee doth counterfet it.

3. Question.

The third question is why wee do conceiue a song to be more pleasant in consort with a pipe then with a harpe. I answer, because both the sounds are heard distinctly by themselves and better mingled together, for both a mans voyce and the sound of a pipe are accomplished by a breath within, but the sound of a harpe is not so. Againe, it may be thus answered, because a pipe, whose sound is somewhat akin to the voyce, doth drowne many faults in the song, which the sound of a harpe doth not being fine and small and vnfit to consort with the voyce, but is heard distinctly by it selfe carrying his owne tune simple & pure and so discouers all the slips and errours of the song by his owne iust and proportionable harmony. Now seeing that in singing many things happen out of order, that sound which doth most of all bewray the confusion that is betwixt harmony and discord must needs be more harsh in the Eare.

4. Question.

The forth question shall be, why children when they heate musicke doe first cease their crying and after fall asleepe. *Alexander* in the 121. Probleme of the first booke, rendereth this reason of it: because there is a kinde of harmony in the soule by instinct, as other sciences be; neither doe wee obtaine any thing by doctrine as *Plato* affirmeth, but onely by recalling to mind. As often therefore as the soule perceiueth any pleasant melody, she as it were, repeating and calling to mind her owne Nature, causeth the infant to cease crying, and luls it asleepe by drawing it selfe from the trouble of outward obiects.

These are the Platonists arguments.

Aristotle.

But *Aristotle* more truly resolueth this probleme in the 39. probleme and 19. section, where hee demandeth why all men are wont to bee delighted with numbers, tunes and all kindes of musique: Is it because euery thing according to Nature is done by number and measure, that so it might tickle and delight our Senses or our minds? Surely a great argument of the exact and curious disposition of Nature we may finde in our selues, for when we labour, drinke and eate ordinately, that is, according to our proportion (the scantling whereof is most commonly taken by experience) wee doe not onely conserue the naturall disposition and frame of our bodyes, but also increase our strength and perpetuate the vigour both of body and minde: on the contrary, when we liue dissolutely, that is, inordinately, all things runne headlong into detriment. In like manner the resonance or consonance which wee speake of, is, nothing else but an ordinate or proportionable mixtion or temper of contraries amongst themselves, which contraries if they keepe quarter and make, as it were, faire warre, there is a kind of military order or consent in disagreeing. *Aristotle* therefore conceiueth that the consent of words doth therefore refresh, please and delight the Eares, because it is compounded according to certaine lawes deriued or taken from the nature of the thing. Neither is this onely true in the Sense of Hearing, but also in the obiects of the other Senses, for in a picture onely those colours doe delight the Eyes, and in a feast those flavours the Taste, which are tempered after a certaine manner and proportion. *Aristotle* addeth further, that not onely Muscical sounds, such I meane as are made according to art, but those which they call *modi adiecti*, that is, extrauagants, such as wee call voluntaries or the blacke Sants doe oft times delight vs, especially if wee be accustomed vnto them. The

Examples in
our selues.

reason

reason is because custome is another Nature. Wherefore that which is by custome made proportionable is as well musically as that which is naturally melodious.

A fifth question may bee why he that singeth the *Base* is sooner discovered if he make any iarre then hee that singeth the *Treble*: the like happeneth in numbers, for in that which is greater, the error is more evident; but let vs giue the reason. Wee say therefore it is because the base sound consumeth more time, and by that meanes is better perceived by the Eares; but the Treble sound is swift and doth easily and suddainly passe away.

5. Probleme.

A sixth question is, why wee doe not heare well when wee yawne. I answered, that in the act of yawning, (which the Latines call *Oscitation*) wee shake out and disquiet a dull and sluggish winde which lurketh in the cranies and chinke of the throate, which winde attaineth vnto the Eares by those perforations which are made from them into the palate, stoppeth and fullfillet the Organ of Hearing, and withall caueth a kinde of disturbing noyse which darkeneth the brightnesse or dullerth the edge, or adulterates the puritie which commeth from without: so also wee see, that if two men talke together & at once they cannot heare one another, at least not distinctly, because the sound of eithers voice is repelled by the other, and that is the reason why he that would listen & heare distinctly holdeth his breath.

6. Probleme.

Why yawning hinders our hearing.

Add hereto, that the holes of the Eares are compressed when the *mandibles* or iawes are distracted or drawne asunder by oscitation or yawning. If then the hole of hearing be compressed, the aire which carrieth the Sound cannot so freely arrive vnto it.

The seauenth question is, why if a man bee within a house he will sooner heare a noyse that is made without: and on the contrary, he that is without the house shall not perceiue a Sound made within the house? The Reason is thus rendred, Hee that is without doth not so well perceiue the sound that is made within the house, because the ayre breaking forth is dissipated or deuied in a greater roomth or more capacious place, and so the sound becommeth dull and loseth his vigour being parted with the aire into so manie partes, or stretched into so wide an extent. Againe on the contrary, hee that is within the house doth easily heare a noyse that is made without, because the sound entering into the house is contracted, gathered or vnited, and therefore it must needs moue the Sense more fully. The very same reason seemeth to bee in the act of Sight, for being within doores we see better that which is done without, then if we were without doores we should discern what is done within, for the species coming from without into the house are gathered and vnited. Againe, the visue vertue of the eye within the house which vnder-taketh to view that which is without is easily dissipated or disvnited.

7. Probleme.

The eight and last question shall bee, whether when many men talke together they can bee heard further then if one man onely spake, imagining the voyces to bee equall. This question made *Aristotle* at a stand, yet he resolueth it thus in the second probleme of the 19 Section: It is (saith hee) because it is more easie to worke with vnited powers then with single and separate, for all compound things are of greater force then Singulares. Wherefore when many mens voyces goe together, the Sound must needs be constant and vnited, and so drue the aire much further then otherwise it should bee driuen by a single Voice in the same Key.

8. Probleme

A pretie question. Aristotle.

To *Aristotle* wee adde Experience and example. Experience, because you may heare the tumult of an Armie further then the vociferation or crie of one Souldiour.

Experience.

Againe, in Markets & Fayres where many people are assembled, the murmur of the multitude is heard further then the voyce of one man though hee bee lower then his Fellowes. The noise of a Frogge is not great I wis, yet what time they breede they may bee heard many miles out of the Isle of *Elie*. Neither are wee to wonder at this, for wee haue examples of the like in the obiects of other Senses. As many Candles of an equall bignes will enlighten the aire further then one Candle though it be bigger then any of the other. A heap of sand may be seen a great way off on the Seashore, but a moate of sand can scarcely be discerned vnder the eye. If therefore it bee so in the visible obiect, why should we not acknowledge it in the audible? For although the species of particular voices are not vnited, yet where there is a totall aggregatiō or heaping vp of many species together, they may produce one that may attaine to a further limit then any of them could doe in particular.

Examples.

I know well that *Aristotle* in another place, that is to say the 52 Probleme of the eleuenth Section seemeth to contradict that we haue before alleaged out of him, which was the reason

Aristotle contradicts himselfe

reason that I said before *Aristotle* was doubtfull in the resolution of this Question, but because that which we haue quoted is the last, and after-thoughts (they say) are the wisest, we will rest our selues therein: for if we should take occasion to dispute with *Aristotle* too and fro alwaies when we haue occasion offered, we should weary our selues, and forget that our Philosophy is not of the maine, but by the Bye. Wherefore we returne againe to our Anatomy.

QUEST. XLIIII.

Of the wonderfull sympathy and consent of the Eares, the Palate, the Tongue, and the Throttle.

The sympathy
of the eares &
instruments
of the voyce.

Here be many things which doe manifest this wonderfull communion of the Eares with the Instruments of the Voyce, which that *Genius* of Nature *Aristotle* in the 32 Section of his *Problemes* hath declared. For when we would heare any thing attentively we hold our Breath, when we yawne we doe not heare so exquisitely. And if you goad the Tympane of the Eare with an Eare-picker it will presently cause a dry Cough. Those which be halfe deafe doe speake but stuttringly, and their Voyce is made thorough their Nose. Againe, those who from their Birth are Deafe, are in like manner Dumbe. Lastly, if you hold an Instrument in your Mouth or betwixt your Teeth and stop your Eares, you shall heare more perfectly; whence it is that deafe Men doe heare best by their Mouthes. All these are certaine and plaine Arguments of that communion and sympathy which is betwixt the Eares and the Vocall Instruments, to wit, the Mouth, the Tongue and the Throttle.

Whence this
communion is.

But the reason of this communion is not knowne to all: Some thinke, that the Auditorie Nerue, or the Nerue of the fifth Coniugation, and that of the seuenth which moueth the Tongue are couered with the same Coat from their beginning, and therefore the affects of those parts are easily communicated: But Ocular Inspection doth perswade the contrarie, for the passages and wayes of either Coniugation are diuers, and there is a great distance betweene them. We (saith *Laurentius*) will acknowledge a double cause of this communion: The one is referred vnto the Auditorie Nerue, the other vnto a little Canale or Pipe which was vnknowne to the Ancients.

A double
cause of this
communion.

Hippocrates his
community of
vessels.

The Nerue of the fifth Coniugation brancheth out into many Circles, the larger is dilated into the Eare and the Membrane of most exquisite Sense, and carryeth the *Species* or formes of all Sounds vnto the Braine; the lesser runs vnto the Tongue and the Throttle. The affects therefore of the Eares and the Tongue are easily communicated by reason of the communion of the Vessels, which according to *Hippocrates* and *Galen* is the onely cause of this sympathy. Hence it is that the Membrane of the Eare being prouoked or goaded doth cause a dry Cough, whereof *Auicenna* maketh mention of which I spake before. Hence also it is, that almost all deafe Men be dumbe, or at least haue but an imperfect Speech, the Auditorie Nerue being affected, which is complycated or folded with the seuenth Coniugation: For I do not approue of that common Position, that deafe Men be therefore dumbe because they can learne no Language, and because Hearing is the Sense of Knowledge: for if they were onely dumbe for this cause, wherefore should they then sigh and mourne with so great difficulty which are naturall Passions? Why should they not, as well as those which were the first Inuenters of things, faigne Language and words whereby they might expresse the Thoughts and Discourse of their Minds if they could vter them? For Nature hath armed a Man although he be deafe with Reason and Vnderstanding for Inuention.

The second
cause of the
sympathy.

Reasons of
the former in-
stances.

It remaineth that we proceed vnto the second cause of this consent, which is by a Gristly Canale like a Water-pipe, which is conueyed from the second hole of the Eare vnto the Mouth and Palate. This Course or pipe was appointed for the purging of the in-bred Aire, for the auoyding of the Excrements of the Eares, as also that the in-bred Aire might be recreated by the arriual of new Aire inspired by the Mouth; and lastly, that by this way a passage may be open for the externall aire rushing forcibly through the hole of the Eares, as it is in the noyse made by Ordinance when wee are neere it. The Ayre therefore doth passe frelie out of the mouth into the Eare, and againe retireth from the Eare into the mouth. Whence it is, that when wee would heare more attentiuely wee holde our Breath, least the *Cochlea* or *Snail-shell* should be filled with abundance of inspired Aire and so the Tympane bee stretched. But such as yawne doe not heare so well, because in this yawning or gaping the Tympane is so stretched and puffed vp, that it cannot receyue outward Sounds.

Lastly,

QUEST. 45. The sympathy between the eares and Vocall Instruments. 701

Lastly, by scratching the Eare wee prouoke Spittle, because by that comprehending there is an expression of Excrements into the Cartilagineous or gristlelike passage, and so from thence vnto the Tongue. And thus much of the Sense of Hearing, now wee come vnto the Smell.

QUEST. XLV.

What Smelling is.



That the Nose was by Nature made as well for Respiration as for the Sense of Smelling, we haue before declared. But what is the Sense of Smelling, that wee doe vndertake in this place more precisely to vnfold. Smelling therefore is the middle Sense of sense, which perceiveth the odours of things drawne in by the Nostrils for the vse and behoofe of the Creature.

The definition of smelling.

It is a great question (which also wee haue a little touched before) whether to the action of this Sense the Inspiration of aire together with the odour be of absolute necessity; and yet the streame and current of mens opinions as well Philosophers as Physitians run vpon the affirmatiue part. For if wee desire or bee willing to endeavour our selues to Smell any thing more curiously, we draw the ayre in at our Nostriles, and that is the reason why wee cannot smell in the water, because the water that is drawne filleth the passages of the Organ. Placentinus is of the contrary opinion and alledgeth Aristotle for his authour in the fifth Chapter of his Booke *de Sensu & sensib.* where he sayes that Nature doth but collaterally vse Respiration in the Attraction of odours, which Respiration, sayth he, she destined primarily to another end.

Whether inspiration be necessary to smelling.

But if Respiration bee necessary to the Smell, then it followeth that Nature ordayned it primarily for that end. For, sayth hee, this is a rule in Nature, that whatsoever in our bodies doeth necessarily belong to any function that is primarily appoynted for that function, and doth not sort vnto it by error, chance or accident.

Seeing therefore the primary and chiefe vse of Respiration is to refresh and cherish the heart and his spirits, it followeth that it is not altogether necessary for Smelling.

Indeede one and the same thing may haue diuers vses, but the principall and primary vse is but one, for which onely it is necessary and to the rest accommodated onely secondarily or by accident. Againe, if an odour of it selfe bee fit to ascend vnto his owne Organ why should wee thinke that Respiration should bee so absolutely necessary. Now an odour is nothing else but a hot and dry exhalation as we shall proue afterwards, and exhalations of their owne Nature doe tend or moue vpwrd. If then they ascend naturally, why may it not be that a sweet and pleasing breath may rise into the Nostrilles and passe on vnto the Organ of smelling without any attraction of the ayre?

Placentinus addeth another argument which hee called Inuincible, taken from those women that are Hysterically, that is, haue fits of the Mother. For such women although they haue no Respiration at all, doe yet receiue and perceiue odours, and not onely so but are almost miraculously redeemed or recovered by them: what shall wee say vnto the wombe it selfe, doth it not smell? yet no man did euer say that the wombe did respire, and dayly experience teacheth vs that it taketh so great pleasure in sweete Smells and is so offended with that which is noysome and abominable, that it moueth and applyeth it selfe manifestly vnto the one and auoydeth the other, euen with Locall and Mathematicall motion.

Fits of the mother are holpen by smells.

The wombe follows sweet fauours.

But it may bee objected, that if we hold our breath wee cannot smell, and therefore this Sense is not accomplished without Inspiration. Placentinus answereth that it is not true, that if an odour bee applied to the Nose and the breath retayned, no Sense will bee made; and those who vrge experience are deceiued in their experimenting. For the breath cannot bee so retayned that nothing at all should either get in or out. If then any thing enter in it helpeth the attraction of the odour: if any thing get out it hindreth the same, yea it repelleth or driueth it from the Organ. And that the breath cannot bee so immouably retayned, may be conuincied by reason and experience.

Objection.

Salution.

Reason sayth that because such retention of the breath is violent and against nature, Nature will likewise with all his force and vigour resist and oppose that violence, and beside that, all the Organs of Respiration doe by a proper instinct hasten to their Naturall Action.

Hence

Hence it followeth that the Muscles of the brest staggering as it were in their worke of sustentation, and the Lungs declining downward, by their waight doe betwixt them perpetually expell some small quantity of ayre, which is a subtile and fluide Element, and will find way through insensible passages. Now that there is such an instinct in the muscles serving to Respiration, and that this instinct may doe much we may easily coniecture, because though a muscle is otherwise an instrument of voluntary motion; yet even in sleepe when all election is absent, and the will (especially vnto motion) is at rest as well as the body; yet even then the intercostall muscles, and the midriffe which serue for Respiration doe follow the necessity of Nature, and mooue as freely as when we are awake. Shall wee therefore conceiue that vpon the same necessity or a greater, when wee our selues doe voluntarily seeke to oppose and frustrate the end of Nature, shce shall not be able without our knowledge and against our wills to let out so small a quantity of Ayre as may suffice for this her purpose, of Ayre (I say,) which is so subtile and fluid a body that it will issue at the least crannie and yeeld vnto the least impulsion though without violence.

Experience confirmeth the same thing: for if you burne any thing that is odoriferous vnder the Nose and retaine your breath, you shall finde, nay you shall see that that fume will bee mooued on this side and on that side, which no doubt commeth to passe by reason of the Ayre which passeth and repasseth outward and inward: but if it get within the nostrils then it doth presently sent, as any man that list to try may perceiue in himselfe. Indeed some men of no small estimation haue affirmed that wee cannot smell if we retain our breath, but the true reason is, because the odour doth not attaine vnto the Organ, nay it doth not enter into the nostrils, for therein they are deceiued. They thinke they canne hold their breath immouable, whereas indeede the naturall instinct driuing their breath forth, doth also driue the odorable obiekt from the Organ; but let them proue that though a fume doth of it own accord ascend into the cauities of the nostrils, yet it is not perceiued by the Sense of smelling vnlesse they adde respiration thereto, and then I will yeeld them the bucklers.

Question.
Answer. The
conclusion.

You will demand, if Respiration be not necessary, why doe we purposely draw our breath when we would smell.

The answer is at hand, to wit, that the obiekt may sooner and more plentifully attaine vnto the Organ. Wee grant therefore that Inspiration helpeth the Smell much, but it doth not thence follow that it is necessary. Againe, to the maintenance of life Inspiration is absolutely necessary, but for *better life*, not so, but onely by accident or secondarily. In like manner wee confesse that the sense of smelling is not ordinarily without Respiration but yet it may be; and Respiration is not necessary to the being, but to the better beeing of the Sense. And if nature had prepared the way of Respiration through some other member, and not through the Nose; yet vndoubtedly the Nose would haue smelt, as we may see in those creatures which doe not respire. And this is *Cassorius Placentinus* his opinion.

QUEST. XLVI.

Why Man doth not smell so well as many other Creatures.

In *Timaeo*, and *Theophrastus* in the sixth chapter of his sixth booke *de causis Plantarum*, together with many other who haue written of this subiect, all of them, I say, with one consent doe acknowledge that the Sense of Smelling is more dull in men then in many other Creatures.

The same doth *Aristotle* auouch in the fourth chapter of his booke *de sensu & sensibili*, where hee also addeth that of all the senses this Sense of Smelling in man is most sluggish and dull, which also he confirmeth in the 92. text of his booke *de Anima*.

What creatures smell better then men.

The truth of this opinion is very euident by the example of other creatures as Dogges, Hogs, Crowes, Bees and other birds and beasts which are able a farre off to *wind*, as wee say, the sent of any thing. But man is constrained to moue the obiekt euen vnto the Nose, and yet he is not able to discerne or perceiue any smells but those, that are so strong that they alter the Sense either into pleasure or paine. Add hereto, that many brute beasts doe know more by their smels then man can attaine to by all his senses, as the Hound that hunts vpon the cold foote of a Hare or a Deare, yea they can in the night follow a mans steps

Beasts smell many things that men cannot.

steps, and by resending worke out his way through a thousand difficulties and intanglements or permixtion of other Smells. So wee see also in the darke a Dogge will know his owne master from a great many other men onely by his smell. A Tyger being robbed of her whelps will finde them out againe by her smell. Now none of these odoures can the Sense of smelling in man apprehend.

The reason hereof *Aristotle* in the place before quoted referreth vnto the fault, not of the faculty, but of the Organ. For this Organ is cold and very moyst, but the object hot and dry: now it is necessary that the Organ should potentially bee such as the subiect is actually, so that when sensation is made, the object may worke vpon the instrument and conuert it into his nature. But in this Sense of Smelling such conuersion cannot be made without great difficulty, for that which is moyst doth hardly become dry, and by reason of this difficulty a man smelleth but remissly or dully, that is, not without either pleasure or paine. The reason is, because the Object must bee very vehement before it can turne the moysture of the Organ into his owne Nature, that is, make it hot and dry.

The reason
of it.

Beside this proper and natie vnfinesse of the Organ, there is also another ineptitude added; and that is the vicinity or neighbourhoode of the braine, which is in man much greater in respect of his proportion then in other creatures. Seeing therefore the braine aboundeth with moisture, which moisture is also imparted vnto the Instrument of Smelling, it commeth to passe that that Instrument by this coniunction of the braine becometh more vnapt. Whence it is that the same *Aristotle* in the 33. Probleme of the tenth Section, hath obserued that the Instrument of Smelling is much incommodated by the moyst superfluities of the braine. The power therefore of Smelling being as it were steeped in this moisture groweth dull and sleepy, which in that which is hote and dry would bee awaked and shew it selfe; and therefore in brute beasts whose braines are not either so moyst, or at least yield not so much moisture because they are lesse, this Faculty or Sense is more pregnant and apprehensiu.

Other reasons.

Some arguments are neuerthelesse made to the contrary, for thus they say: Where the forme is more excellent, there also the faculty is proportionably excellent. Now wee know that the forme of a man which is his Reasonable soule, is farre more excellent then the Sensatiue forme of a brute beast, wherefore the faculties also of his forme are more perfect, and among the rest that of Smelling.

Objection.

Wee answer, that albeit the Soule of man is much more excellent and diuine then the Soule of a beast, yet so long as it is chained in the prison of this body of Earth, it cannot performe his functions but by the helpe of corporeall Organs, and therefore as the Temperature and conformation of the Organs is more or lesse conuenient, so are the functions more perfect or imperfect. Seeing therefore the Organ of Smelling by which as by a hand the Soule reacheth odours vnto it selfe, is as wee sayd in men somewhat too moyst, and therefore vnfit for the sodaine and quicke reception of odours: it followeth that by reason of this fault of the Instrument the faculty of the Soule is as it were abated or allayed that it cannot so perfectly and freely manifest it selfe.

Solution.

It may be objected againe, that because the Organ of a mans Smell is colde and moyst, hee should Smell the better not more dully, for that which is hote and dry as odours are, doth worke more powerfully vpon that which is the coldest and the moystest.

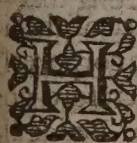
Objection.

True it is, that the odour will worke better vpon the Organ, but as I said before, cannot so easily conuert it into his owne Nature, for the qualities of the Organ are in a great degree contrary & repugnant to the nature of the Object, but when sensation is made they must grow to be alike. Wherefore if the Organ be so disposed that there is not so great a difference betwixt it and the nature of his object, it commeth to passe that they consent better together, and the Organ yeeldeth more easily toward the Nature of that which doth importune it: But wee proceede vnto the Nature of an Odour.

Solution.

QVEST. XLVII.

Of the Essence of an Odour.



Heraclitus, as *Aristotle* remembreth in the fifth Chapter of his Booke *de Sensu et Sensibili*, conceiuing that Odours are a fumide exhalation, sayeth, that if all Beings had bene fumide the Nose would haue discerned of all. *Aristotle* replies vpon him on this manner. If that were true which *Heraclitus* collecteth, it would follow

Heraclitus opinion of Odours.

Refuted by *Aristotle*

follow that those creatures which liue in the water do not Smell, for in the water there can bee no fumid or smoky exhalations generated. But that Fishes doe smell may bee proued by the choise of their meate, which *Aristotle* perswades himselfe they make by Smelling.

Wee, saith *Placentinus*, haue other Reasons against this opinion: First, because a fumid exhalation is a substance, for it subsisteth by it selfe and sustaineth accidents, and therefore naturally and by his owne motion wee perceiue that it moueth vpward. Now then if an Odour were a fumid exhalation, it could not bee by it selfe sensible, for no substance doth by it selfe fall vnder any Sense. Yet no man will denie but that an Odour doth by it selfe and immediatly worke vpon the Organ of Smelling.

Placentinus re-
futation of
Heracitus.

It is true indeede that a fumid exhalation attayning to the nofethrills mooues the Sense of Smelling, but it doth not follow that therefore such an exhalation is an odour: rather wee should say that the Odour hath his subsistence in the exhalation as in her subiect, for accidents neither are, nor can be without their subiects.

A place of
Galen ex-
pounded.

Notwithstanding there is a place in *Galen* neere the end of the second chapter of his booke *de odoratus organo* which seemeth to prooue this opinion of *Heracitus* to bee true: the words are these; *That falleth into the Sense of smelling which is betwixt the Nature of ayre and water, to wit, such a thing as is neither so thin as aire nor so thicke as water, for that which exhalet or vapoureth from the bodyes of things is the substance of odours, which wee may perceiue by Roses and the like tender plants whose bodyes doe quickly become lesse, crumple and dry vp, whence wee may certainly gather that the more humide part of their substance is resolved in to exhalation.* Thus farre *Galen*.

And answered

Wee answer that *Galen* saith the substance of an odour is an exhalation, by substance there meaning the subiect wherein the odour doth consist, for it had bene a grosse thing in *Galen*, and vnworthy the edge of so keene a Philosopher, if he had attributed substance to an odour which hath no existence of it selfe.

And if any man shall insist vpon the example of Roses, wee will giue him this satisfaction, that *Galen* doth not conclude that Roses therefore doe become lesser and dryer, because their moystest parts are exhaled into odours, but he saith that their moyster part turneth into an exhalation: and hee saith true, for an exhalation which is a substance absumeth the humiditie of the body out of which it issueth, and diminisheth the same, for how can it bee but diminished when a substantiall part is taken from the whole? But an odour is not a substantiall part, neither is it made of a part, but subsisteth in the whole subiect, and is nothing else but an accident or an incorporeall qualitie. So that out of these words of *Galen* wee may gather this excellent point of learning. That where he saith, *That which exhalet from the bodyes of things is the substance of an odour*, hee doth wisely signifie the matter out of which the odour doth arise which is the body, and the subiect wherein it doth inhere which is the exhalation; whereas therefore hee saith that the exhalation is the substance of the odour, he doth not meane that the odour is a substance, but being an accident that it doth subsist in this substance as in his subiect.

A story out of
Plinie.

But for the confirmation of this opinion of *Heracitus* there are some obiections made to prooue that the odour it selfe is a fumid substance, because it performeth many things which cannot be done, but onely by a substance. And first, a creature may thereby bee nourished, for which they alledge *Plinie* in the 2. chapter of his seuenth booke where hee saith that in the Easterne India about the fountaine or head of the Riuer Ganges, there is a nation without mouths, whom he calleth *Astomy*, hairie all ouer their bodyes and cloathed with the leaues of trees. They liue of nothing but exhalations and odours which they draw in through their Noses; meate they haue none nor drinke: onely they vse to smell vpon certaine rootes and flowers and wilde Appels which they carry with them when they trauell farre, that they might not want something to smell to. These men are easily stified with a strong odour.

The *Astomy*.

Democritus

The like wee reade of *Democritus* who they say sustained his life foure dayes with the smell of honey or hot bread. Wee answer that *Aristotle* in the fifth chapter of his booke *de sensu & sensibili*, where he ascribeth this opinion to the *Pythagorians*, that such strange reports are mere fables vnworthy the credite of a history, because they abhorre so much from reason. For those things which do nourish must be conuerted into the substance of the liuing body. Now that which is incorporeall cannot possible be conuerted into a corporeall substance; wherefore odour being of it selfe an incorporeall accident and therefore not changed into the substance of the creature cannot become a nourishment therto, Beside all

Reasons a-
gainst *Plinie*

creatures

creatures haue some place in their bellies which receiue their meate, and from whence the body draweth that which sustaineth it. But the Organ of odours is seated in the head from whence no member of the creature seeketh for nourishment.

They vrge further the example of Cooks, who because they are busie in boyling and roasting viands for other men, doe receiue so many odours from them that they scarce euer are a hungry or desire meate, but rather being satisfied with the smell doe loath the substance, and therefore it is commonly thought that these smells doe satisfy and cloy them. But we deny that this commeth to passe by reason of the odours of meates, but the reason why they desire not meate as other men, is, either because (as it is in the proverbe) they can licke their owne fingers, that is, tasting a little of euery thing they insensibly fill their stomackes; or being alwayes about the fire their pores are opened and the inward heate dissipated which is wont to moue and solcite the appetite, which also is the reason why euery man in winter eats more then he doth in Summer; Or we may say, that they are dried by the heate of the Fire and so become thirsty and drinke often, insomuch that the stomacke being relaxed or loosened by the moisture of drinke becomes languide and so the appetite is broken: or wee may say further, that being very dry they cannot be hungry, because *Aristotle* sayeth it is impossible that at one and the same time a man should vehemently desire both meate and drinke.

It is further objected that as *Aristotle* sayes in the fift Chapter of his Booke *de Sens. & Sensi*, which also is prooued true by experience, that when we are full wee loath the Smell of meates, but delight in the smells of Spices and Roses. If therefore the odour of meate did not nourish, a full stomacke would no more abhorre the odours of meate then of Roses or Spices.

But we answer that this faculty hapneth not because of the odours, but because of the steame or exhalation wherein the odour is; for wee grant that such a steame may in some sort nourish, but the odour of Roses which hath for his subiect a more subtile exhalation is better pleasing vnto vs, especially because their smell is very fragrant and acceptable, whereas the Smell of meates is neuer pleasing but when wee are an hungry. Wee conclude therefore with *Aristotle* in the place before quoted, That odours doe not at all nourish. Others disputing more probably doe make according to *Galen* two kindes of nourishments; one which is taken by the mouth and nourisheth the solide partes of the body; another which is drawne through the Nosthrils which nourisheth the thin & airy parts, as the spirits, for *Galen* affirmeth that the spirits doe feede vpon ayre and odors.

Wherefore the nourishment of the spirits they attribute vnto odours, and the rather are they induced so to thinke because nasty and abominable smells doe make men oftentimes ffound, yea and such exhalations arising from dead Carcasses or muddy fens doe infect the ayre and breede a pestilence. Adde hereto that in the Low Countries the odour that ariseth from the flowers of beanes as they grow in the fieldes, doe often driue travellers into a deliration or light madnesse, as *Leuius Lemnius* hath obserued. And *Plutarch* sayeth that by the smell of oyntments Cats doe grow mad. Moreover, Physicians doe consent that the smell of spices doeth breede *καταπληξια*, that is, a payne or dull stupidity and fulnesse in the head.

Adde hereto that many odours or smells are able to refresh a man when he is ready to ffound or faint away; they exhilarate or cheare the heart, and if we may beleue *Aristotle* in the place before quoted, they correct the distemper of the brayne. All these things wee confesse are true if they be vnderstoode of that vaporious or airy exhalation or substance wherein the odour is transported, for by that meanes or in that respect onely the odour is sayde to nourish the spirites, and *Galen* in his 8. Booke *de compositione medicamentorum secundum locos* and the 4. chapter writeth, that if with the odours there are also many vapours associated, then, sayth he, such odours haue some faculty to nourish. But if we vnderstand by odours the simple object of the smell, naked and separated from exhalations, it is vtterly false that they say; for although that vaporious substance wherein the odor is conuayed doe by the helpe of other qualities concomitating or accompanying the odours cherish and refresh the spirites and performe those other good offices which wee haue remembred, yet it followeth not from hence that an odour is a substance; rather that it is an accident of a substance, because it doth inhere in the forenamed qualified vapour. But we will come vnto the definition of an odour.

Why Cookes
haue no good
stomackes.

Objection.

Solution.

Some say that
odours nourish
the spirites.
Their reasons.

Answers.

QUEST. XLVIII.

The definition of an Odour.

What an odour is.

N Odour is a quality moving the smell, arising out of a fit mixture of the four Elements wherein heate and moisture have the predominance. For we conceive with Aristotle in the fifth Chapter of his Booke *de sensu & sensibili*, that in the pure and sincere Elements there is no odour at all. Aristotle in the beginning of the chapter rendereth the reason, because they can have no Taste unless they be mingled: for the Taste and the Smell, that is, the sapor and the savour or odour doe arise out of the same matter; yet so that in sapsors there is more moisture, in odours more ficcidity: notwithstanding in odours the ficcidity is not at any time without some humour, for those things that wither and are torried do lose their odours, as may appear in the ashes of Juniper, for as soone as all the humour is consumed, the odour or smell vanisheth also therewithall. Again, some that are over-dried recover their smells by the permixtion of moisture.

The drought is predominant in odours.

But that in odoriferous things the ficcidity is predominant, may be proved, because such sweet smelling flowres or what else you shall name, become without smell if they be too much moistened: hence it is, that *Roses* gathered in the raine do smell verie little, nothing at all in comparison of the fragrancie of those that are gathered in faire and dry weather. That also is the reason why in Egypt the flowers are not sweete, because the aire is moist and cloudy by reason of the waters of *Nylus*. On the contrary the hot Climats of the East as *Arabia*, *Syria* and the *Indies* do bring forth Spices and other plants of excellent and delicate Smells. It may be objected there are many waters which are verie odoriferous, now no man will denie but that in water the moisture exceeds the drought. We answer that in water the odour is onely potentiall and that the heate eleuateth or raiseth vp from out of them a vapour or exhalation wherein the ficcidity preuailes over the humidity, and in this vapour is there an Actuell odour. The Reason is, because this mooueth the Sense, but the other odour which is in the water cannot mooue the sense unless it exhale together with the vapour and attaine vnto the organ.

Why in Egypt the Flowers do not smell. Objection.

Solution.

The truth of this we may easily admit if we draw into our Nofethrils a little sweete water, for so we shall not smell the odour thereof, because of necessity a vapour is required to actuate the odour.

Moreouer, that all that odour is potentiall which consisteth not in a vapor but lurketh as yet in mixt bodies, may be convinced by inuincible argument. For Aristotle in the fifth chapter of his Booke *de sensu et sensibili* saith, the subiect of Sapsors and sapsors is one and the same. If therefore in odours or sapsors ficcidity be predominant, in Sapsors or Tasts humidity, it would follow that two contraries should be predominant in one and the same subiect, then which what can be more absurd?

Potentiall Odour what it is.

We must say therefore, that these qualities are in mixt bodies not actually but potentially, and that they arise out of the mixture as out of their matter: so that when we say that ficcidity hath the predominance in odours we speake of that odour which exaleth into acte out of the mixed bodies, and so there shall be no contrariety in that we affirme: neither let any man thinke it absurd, that we say two contraries may be potentially in the same subiect, for water that is tepide or warme, that is, in a middle temper betwixt colde and hot, is potentially both colde and hot at one and the same time, for it hath an equall disposition to them both, and the reason is, because potentiall contrariety breedeth no strife in a Reall subiect.

Heate is the efficient cause of Odours.

A Rule for Herbalists.

Quest. XLIX. Of the Causes of Odours. Although the Nature of an odour doth consist in ficcidity, yet it cannot be at any time without humidity, yea it is generated out of humidity, eleuated or raised vp into vapours by heate: so that there can be no odour unless the force and efficacie of heate doe boyle, rise vp and attenuate the humidity. And this all Herbalists acknowledge for a rule, (to wit) that all things that Smell strongly are hot, so that from the vehemencie or remission of the odour they do in Hearbs distinguish the degrees of heate.

So saith *Aristotle* in the 12 probleme of the 12 Section, strong and ranke-smelling seedes are hotte because the odour proceedeth from Heat. The like also *Galen* affirmeth in the 22. *Galen*. chapter of his fourth Booke *de Simplicium Medicamentorum facultatibus*.

Experience also manifesteth the same, for perfumes are more fragrant when they are Hot then when they are Colde, and in hotter seasons yeelde a sweeter smell; which is an Argument that the moysture is better boiled away, and that there is better plentie of Odour raised vp in the aboundance of exhalations which cannot bee loosened and freed from the bonds of the matter wherein they are vnlesse it bee by heate, for cold doth binde and shut them vp, neither suffering them to yssue out of their substances, nor giuing them way to attaine vnto the organ of sense. And after this manner *Plutarch* in the 25 Chapter of his Booke *de Causis Naturalibus* asloyleth the question, why in a frostie morning Hounds cannot hunt so truely as in open weather.

Sweete things
smell most
when they are
hottest.

why Hounds
cannot hunt
in frost.

But it will bee objected, if the odour bee not a fumide exhalation what neede hath it of moysture and heate which are the causes thereof? Wee must remember that whereof wee were admonished before: That Odours in mixt bodies are onely potentially and cannot bee produced into an acte vnlesse they yssue out of them: wherefore being an accident it cannot yssue out of his subiect wherein it was potentially, vnlesse some other subiect doe accompany it: for saith the Philosopher, the Being of an accident is to bee in. For out of their subiect they are nothing. This subiect therefore which produceth the odours into acte is an exhalation. An exhalation cannot be raised but by heate out of moysture. It followeth therefore that both heate and moysture are necessarie in the production of odors. Necessary, I say, not *per se* as they are odours but *per accidens*, because they cannot actually exist without an exhalation.

Objection.

Solution.

They vrge further, if an odour be of and by it selfe nothing, then there can bee no knowledge thereof, for there is no knowledge of that which is *Nomens* or without being. Againe, a substance *per se* or by it selfe cannot be knowne, and therefore (say they) we take away euen out of the vniuersall Nature all Science, for whatsoever is, is either a substance or an accident, third thing there is none. Indee we grant, that of an odour considered by it selfe and separatedly there is no knowledge, for so considered it is nothing, neither doth it fall vnder Sense, but as it is ioyned with the exhalation it moueth the Sense and also falleth vnder Science or knowledge. In like manner Accidents separated from their substances, and substances separated from the Accidents doe not fall vnder Science, but each by other is mutually knowne and demonstrated.

Objection.

Solution.

No knowledge
of a necessitie
without the
substance.

QUEST. L.

Concluding that Fishes do not Smell.

Some *Peripatetician* (saith *Placentinus*) may object on this manner. If an Odour haue Actuell existence onely in exhalation, so that without it it cannot moue the sense, then what shall wee say to Fishes which liue in the water where there are no exhalations to bee found? For *Aristotle* in the beginning of the fift chapter of his Booke *de Sensu & sensili* saith, that there can bee no fumid exhalation made in water. The reason is, because as soone as ayre is engendred in water it riseth vp out of it in a bubble. Wee may answer, that the Fishes do not liue in the pure and neate element of water, but in a water compounded of foure Elements: being therefore compounded there is some fire in it, Fire alwayes worketh, that worke consumeth moysture, and such consumption is absolved by exhalation or eleuation into vapors.

An objection
of the *Peripatetician*
saith so.

Water consisteth
of foure
Elements.

Seeing therefore, that in water there may be found such evaporation, it may bee happily imagined that by it the Fishes do apprehend Odours.

But (saith my Author) it may bee this thred is too hard twisted, or too finely spun, because first wee must acknowledge that the Fishes smell is wonderfull dull because of the predominance of moysture and colde in the Water. Againe, I doubt it is ridiculous to ioyne Fire and water, two contraries in the same subiect, which is against the law of contrariety.

And surely this blame we should worthily deserue if we should make the Fire and water equall in their degrees. But wee giue the preheminence vnto the water, and say that the Fire as also the other Elements do put their qualities vnder his girdle. I doe not say that

The Fire is re-
mitted not
lost in the
water.

the qualities of the Fire are extinguished or quenched out by the water, but they are remitted or abated, for fire worketh perpetually wheresoeuer it is, and raiseth vapours although they bee neuer so small, for this action necessarily followeth the essentiall forme of Fire; so that if you separate it from the Fire, you take away the whole substance.

Objection.

Some Philosophers are of opinion, that the foure Elements are onely potentiallie in compound bodies, and therefore haue onely potentiall vertues, so that Fire which is onely potentially in water cannot actually worke vpon it. But wee answer, that if the Water bee actually compounded of foure Elements, those Elements must necessarily be in it Actually, for that which is potentially cannot make an Actuell Being or Existence.

Solution.

But yee will say, if the water be mixed with fire, why doth not the fire warme it? Surely it doth warme it although it bee not able to remooue all the coldnesse of the water that it should appeare warme vnto the Touch: or if the water were pure and sincere, it is certaine that it would be much more cold then our water is.

Why well,
Water is
warmed in
Winter.

And this may bee proued by Well waters which are somewhat deepe within the Earth, for they are hotter in winter then they are in Summer; the reason is, because in winter the surface of the earth is condensed or closed vp so that the internall and elementary heate is preserued within the earth, which in Sommer when the face of the earth is loosed and relaxed issueth into the Ayre. Hence also it is that water after it is once heated ouer the fire, will sooner freeze then other which is newly taken out of a Riuer, because in boyling ouer the fire the inbred heat of the water vanisheth the parts being relaxed or disunited, but in fresh spring water the natieue heat remaineth which preserueth it from freezing. Now these things could not be thus, except that fire were actually in the water, and did also actually heate it, Notwithstanding the Philosophers may in some sort be held excused, because the pure elements distinguished feuerally one from another are in compound bodies potentially, for actually pure elements are not in them. But you will say, that because of the fire which is naturally mixed with the water, there is in the water, some little odour, and that little odour Fishes do perceiue. But this cannot be, for man cannot smell in the water, if Fishes therefore could, it would follow that the Sense of Smelling was more perfect in Fishes then in men, which is vtterly false. Neither is it any answer to say that the water hath odors therein: or is odorated in respect of the Siccity, because this Siccity is onely potentiall, and vnlesse the humidity which is actually and predominant there be consumed it shall neuer be able to mooue the Sense, for actuall odour requireth an actuall Siccity, and that actually predominant.

The Philoso-
phers excused

But some man may obiekt that the fire which is in the water, rayseth vp exhalations and so odours. I grant indeede that in water exhalations may be generated, but none such as *Aristotle* vnderstandeth, that is, odoriferous, because those exhalations are meere vapours wherein the Siccity is yet actually overcome by the humiditie. But humide exhalations which are the subiects of actuall odours are neuer found in water, which also *Aristotle* confesseth. Notwithstanding the same *Aristotle* proueth that fishes doe smell, because they make choyce of their meate, as if he should say, that they choose their meat by their Smells.

The difference
betwixt
moyst and
dry exhalations;

But to returne to that wherfrom wee are digressed, and at length to determine this controuerfie, we say, That Fishes may so far forth Smell as the water wherein they liue doth communicate with the Ayre and fire: for seeing nothing can either bee generated or nourished by a simple element, it must needes follow that Fishes being ingendered and nourished in the water, that water partaketh of the vigour and substance of the rest of the Elements. And this is also manifested by the reciprocall transmutation or change of one Element into another, for no man will deny but that rarified water turneth into Ayre, and Ayre rarified into Fire, which could not possibly bee if the water were pure and vnmixed, for it cannot be imagined how it should receiue or put on, a diuers, yea a contrary nature wherewith it hath no affinity or familiaritie.

Fishes cannot
smell in pure
water.

But if any man shall persist and say that the Sea which is the habitation of Fishes, is the pure and sincere Element of water, free from the commixtion of other Elements, then I say, saith *Placentinus*, that Fishes cannot Smell at all. My reasons are, first, because no Sense is mooued but by obiekt, but water which is not adulterated with the mixture of any *heterogeny* body cannot produce an obiekt of smelling, for odours are in that which is dry, now what is more moyst and freer from Siccity, then pure and simple water? Againe, if odoriferous things by too plentiful effusion of moysture doe loose their odour, how can pure and sincere water haue any odour therein? If therefore Fishes doe smell

as *Aristotle* and other classicke authours doe testifie, it must needs bee in regard of the Siccity which commeth from the permixtion of Ayre and Fire.

If any man shall obiekt that water hath no smell in it, because a man cannot perceiue the odour thereof, though hee snuffe it into his Nose, hauing notwithstanding a greater perfection of this Sense then Fishes haue. I answer, that Fishes and those creatures that liue in the water doe smell without respiration or breathing, and without those many helpes of the Organ which are in men.

Fishes smell without respiration.

Moreover, the water being to Fishes a familiar Element, a little odour mixed therewith may moue and stirre vp their senses, whereas in men there must bee a hot steame raised from that which is odoriferous; there must be also Respiration through the Nose to conuay the same steame through the spongie bone vnto the mammillary processes before this Sense in them can be moued.

But whereas *Aristotle* absolutely concludes that Fishes doe smell, because they make choyce of their meate, that consequence we cannot so well approue; for the choyce or election of their meate may proceede from another cause. When wee are to buy any victuals which we may not Taste, wee make choyce by our eyes, beleeuing that that which is best coloured is also best tasted; why should wee not therefore thinke that Fishes may make choyce of their meate by their sight?

How Fishes chuse their meate by their sight.

Againe, all creatures by an instinct of Nature doe desire and seeke after that Aliment which is proportionable vnto them; for what teacheth the Infant in the wombe to drawe vnto it the mothers blood rather then the rest of the humours? Is it the smell of blood? No, thing lesse, for the Infant doeth not smell at all, yea it draweth the nourishment into the Liuer through the vmbilicall veine by a naturall instinct. After the childe is borne what maketh it to choose the mothers milke before all other nourishment? Is it the odour or smell of the milke? No, for we see that when an Infant is laide to the breast, hee suddenly with a kinde of Naturall force laps his tongue about the head of the brest and suckes very strongly. Shall we attribute this worke of the Infant to the Smell rather then to an instinct of Nature? By no meanes, for if you deceiue a childe with a suckling bottle or any such thing like the nipple of the mothers breast, as soone as euer he tastes that which is therein to differ from the Aliment which he naturally desireth, he will presently cry and not be appeased till he haue his mothers brest againe. And thus much shall be sufficient to haue spoken of the causes of odours and some difficulties coincident with them. Now wee proceed to the differences.

By instinct as the infant.

QUEST. LI.

Of the differences of Odours.



To distinguish the particular kinds and differences of Odours, and to giue them proper names is altogether impossible, partly because this Sense is but dull, and partly because of our owne ignorance, which the best Philosophers haue not bene ashamed to confesse.

Differences of odours very nice

Wherefore those that haue written of this place of Philosophy considering how imperfect our Sense is to make fitte distinctions of this obiekt; seeing wee can smell nothing but that which doth vehemently goade and affect the Sense: they haue thought good to distinguish the kindes of odours improperly & by way of translation by the differences of Sapours and Tastes: neither haue they done this without good ground; for betweene Sapours and Sauors, as in the name, so in the nature there is a great affinity, analogy and proportion, insomuch that the odour or saour dependeth vpon the sapour or Taste. So saith *Aristotle* in the fifth chapter of his Booke *de sensu & sensili*, there is no bodie odoriferous which hath not also a strong taste, defining that to be odoriferous or able to moue the sense of smelling, which hath in it power to diffuse a sapid siccity, and a while after he saith, *If therefore any man shall esteeme both (to wit, aire and water) moist, it would follow that odour will be nothing else but Nature of sapide siccity residing in moisture.*

Therefore referred to taste

The kindes therefore of Odours which fall vnder our Sense are these: Biting, Sweete, Sowre, Tart and Fat. As for rotten smells, these (saith *Aristotle* in the place before quoted) are proportionable with bitter Tastes, because as bitter things are hardly swallowed, so rotten or stinking smells are not receiued into the Sense without a kind of regret and loathing. There are two other differences of odours: the first is common to brute beasts

The kindes of odours

and by accident doeth moue pleasure or paine, as those odours which together with the steame do arise from meat, which are pleasant to those that are hungry, and vnpleasant and offensiuē to such as are satisfied.

The other kinde is of it selfe pleasant or vnpleasant, as the smell that breatheth from flowers, and this is proper to men alone, for they doe not prouoke the appetite more or lesse, but rather by another kinde of satisfaction doe dull and appeale it. Yet wee must not beleue that all the differences of Tastes may be applyed to odours, for who euer said that he felt smell?

Finally, Odours are either Naturall or Artificiall; Naturall odours are those which are naturally in the bodies; Artificiall are such as Apothecaries vse to make for pleasure or for Physicke, of the commixtion of many species, and these wee call compound odours, the other simple.

QUEST. LII.

Of the Medium or Meane of Smelling.

The Philoso-
phers opini-
ons.

Confirmed.
What is the
Medium of
Smelling.

The ayre ap-
proved.

The water
questioned.
Aristotle for it.

Placentinus a-
gainst it.

T hath not yet beene called into question whether the smell standeth in need of a Medium or no, all men taking it for granted, that a Medium is required, partly subscribing to that Axiome so often before iterated by vs, That the object immedi- atly touching the instrument maketh no Sensation; partly because in the 97. Text of his second booke de anima, Aristotle speaking particularly of the Smell, hath assigned thereto a deter- minate Medium or Meane, for in that place he doth not onely take away the doubt whe- ther this Sense bee made by a Medium, but withall hee declarerh by what Medium it is ab- solued and perfected. With him therefore (as there is great reason) we also consent. For Odour hauing his residence in a fumid exhalation, with which exhalation the Odour ex- haleth out of the bodies; that vapour cannot accompany the odour vnto the Organ, espe- cially where the distance is any thing great betwixt the body out of which the odour issu- eth and the organ of Sense, but it must be dissipated vlesse it were preserued by some Medium, yet euen that Medium doth not so preserue it, but by degrees it is dissipated and va- nisheth away. Wee conclude therefore that the Sense of Smelling standeth in neede of a Medium. But what this Medium shall be, that, saith Placentinus, I am not resoluēd of; although I am not ignorant, that all Philosophers with one consent doe agree herein with Aristotle, who saith, this Medium is double, to wit, Ayre and Water.

Concerning the ayre, it is without controuersie the Medium of Smelling because when we draw our breath, we do at the same time also Smell, and beside the Odour that exha- leth out of the mixt body, is not diffused into all wayes, but onely that way which the ayre is diffused. A certaine signe that the ayre is both the Medium and the vehicle of Smells.

Concerning the water Placentinus maketh some doubtē, although Arist. in his 2 Booke de anima, and especially in the 8 chap. of his 4. Booke de Historia animalium, doth strue ear- nestly to proue that to fishes, the water is the true Medium of Smelling. His foundation is, that those creatures which liue in the water doe Smell, which if it be so, it is necessary that there must bee also a Medium, wherein the Object shall bee transported. That Medium cannot be Ayre, for ayre as soone as it is generated in water, doth exhale or bubble vp, as the same Arist. teacheth in the 3 chap. of his booke de Sens. et Sensil. from whence he con- cludeth, that for Fishes the water must needs be the Medium. And truly the consequence were certainly and vndoubtedly good, if the foundation and ground where-vpon hee rai- seth it be true. But we haue called that into question before. Now I will adde onely one ar- gument; and that taken from the Nature of a Medium on this manner. All Odour hath his existence in siccity, & therefore requireth also a Medium that is dry, least the Object should loose his odour, for it is the office of the Medium to conferue the Object; but water being moyst is no way fit to conferue the dry Odour, in respect of the contrariety betwixt them, vnlesse a man will bee so bould as to say that one contrary can be the Medium vnto the o- ther, which is as much as if he should affirme that contraries doe not mutually impugne, but cherish and foster one another. Seeing therefore water which is moyst must needs extinguish or dissolve the Odour which is dry, it cannot possibly be a competent Medium for

for it. Hence appeareth the invalidity of *Aristotles* foundation to wit, that Fishes doe Smell. It remaineth therefore that the ayre onely is the *Medium* of Smelling.

QVEST. LIII.

After what manner an Odour affecteth or changeth the Medium.

IT is a great controuersie amongst the Masters of Philosophy, how the odourable Obiect doth change the *Medium*; that is, whether that alteration bee *Reall* or *Intentionall*. *Auerrhoes* impugning *Anicem*, saith, it is done *Intentionally* as a colour is made of that which is coloured, and hee reasoneth on this manner: If the Odour should bee transported through the aire together with a body, then should there bee a penetration of bodies which is impossible to be, and absurd to say. But *Auerrhoes* is deceiued, because an *Intentionall* Obiect cannot really moue the Sense; Now it is manifest that wee Smell really. That which he obiecteth concerning colour, wee haue disputed already in the precedent controuersies. Adde hereto that *Intentionall Beings* are produced from the Soule and doe depend thereon, and therefore they are called *Entia rationis* Notions of reason. By this concession therefore it should follow, that the Obiect is in the vnderstanding before it is in the Sense, if it were true that a *Reall* obiect did make an impression of an *Intentionall* Odour in the *Medium*.

Did not *Auerrhoes* remember that ruled Axiom, *Nihil est in intellectu quod non prius fuerit in Sensu*? That there is nothing in the mind which is not first in the Sense? And to what purpose should any thing that is in the vnderstanding bee remitted or returned vnto the Sense, seeing things are therefore receiued into the Sense, that they might attaine vnto the vnderstanding. And whereas *Auerrhoes* saith, that there would be penetration of bodies, if the odorable Obiect did really alter the *Medium*, I answer the consequence is not good: for the ayre being a most liquid Element, doth easily yield to any body. Adde beside, that a fumid exhalation being mingled with the ayre, may be caried and recaried with it hither and thither. After this manner also, the opinion of *Philoponus* and *Iandunus*, may bee refuted, who doe affirme that the Odour may really together with the exhalation be caried a good space through the *Medium*, marry the rest of the *Medium* which attaineth vnto the organ of Sense, is altered onely intentionally by the Odour, for a reall Beeing doth alwayes worke really, and that which is *Intentionall* dependeth vpon our vnderstanding. But if some part of the *Medium* were really changed, and other parts intentionally, What is the reason why in remote distances a great tract of the *Medium* is really affected; and in little distances (as when we moue the obiect to the Noses) but a little.

Philoponus & Iandunus refuted.

Aegidius was of opinion that the odour was really produced in the *Medium* as is the Sound, which sayth *Placentinus* is vterly false, for not so much as colour, which is simply and immediatly made out of the mixtion of the first qualities, can possibly after any manner bee receiued in the ayre. How then shall odour which is a second quality bee generated in the ayre. Furthermore *second qualities cannot mutually worke one vpon another*: for one white cannot produce another white, no more can one odour which expireth or breatheth out of a body beget another odour in the *Medium*.

As also Aegidius.

And for this cause wee also must disclaime *Ammonius* and *Boetius*, who say that an odour may passe out of one subiect into another; for although it proceede together with the exhalation out of the bodies into the ayre, yet it doth not change his subiect nor flit into another. But the ayre being made vapourous sustaineth the exhalation together with the odour, conserueth it and is a vehiclle vnto it: yet when the vapour is dissipated the odour vanisheth together, therewith, which would not happen if it were fit to flit or moue out of one subiect into another.

With Ammonius & Boetius.

Wee therefore with *Anicem* doe resolute that the *Medium* is really changed: for that the odour doth really yssue out of the mixed body wee haue proued before: from whence it followeth necessarily that some part of the *Medium*, to wit, that vpon which the odoriferous exhalation doth immediatly worke is really affected. Againe, Odours doe really attaine euen vnto the braine, and therefore there is no question but that the *Medium* is really affected. Those therefore that say it is affected intentionally, as also those that confesse some part of it to be affected really, but other parts intentionally, haue sitten downe beside the Question.

Anicem redeemed.

The Medium is really affected.

For they really affect the braine.

Confirmed by a strange instance.

Science is from the Senses.

Objection.

Solution.

But although the odour proceede really out of the subiect and reach really vnto the braine, yet no man must conceiue that the odour is diffused through the whole *Medium* from the object euen vnto the organ, but it is waisted vpon the wings of the wind or transported by the motion of the ayre. That an odour attayneth really vnto the braine may bee proued; because such odours do sometimes helpe and sometime hurt. The detriment seemeth not to proceed from the odour but from the quality of the subiect which accompanieth the odour, that is, the exhalation. For the odour being a quality cannot haue in it that hurtfull quality vnlesse you will graunt that a quality can bee in a quality. Neither doeth the quality onely of an exhalation affect the braine, but sometimes some seedes of the very substance of bodies that are of subtile partes are transported in the exhalation, which settling in the braine bring forth fearefull accidents and strange effects, as it did in him who smelling oft vpon Basill had a Scorpion bred in his braine. It is therefore necessary we should beleue that the odour is really *perceined* by the organ. For confirmation whereof wee may also adde this argument, That all knowledge or science hath his originall from the Senses. Now science is of a reall not of an intentionall Being. How then shall science which hath a reall subiect take his beginning from the Senses if they receiue nothing but that which is Intentionall?

It is therefore manifest that the Senses doe not *perceine* their objects intentionally but really; and by consequent that the *Medium* is also really affected.

But it may bee objected, if the odour be really imprinted in the Organ, then there is no neede of an externall *Medium*, and beside, that *axiome* will bee false, That the object vpon the Sense doth make Sensation.

Wee grant indeede that there is no neede of a *Medium* which should be betwixt the reall odour and organ, but the vse of the *Medium* is of the conseruation, preparation and transportation of the odour.

QUEST. LIIII.

What is the true and principall Organ of smelling, where Aristotle is confuted.



Alexander hath often testified that in euery perfect organ, there may be obserued diuers kinds of parts. Of these parts some bee principall, to which the action is primarily to be attributed. Some againe be such which make the action more excellent, and others doe conserue the action.

Now that the Nose is the Organ of Smelling no man will deny, but because diuers parts doe concurre vnto the constitutiō of the Nose, to wit, bones, gystles, muscles, small nerues, membranes, & the mammillary processes; it is therefore controuerted betwixt the Physitians & Peripatericks, to which of these parts, as to the chiefe cause, the actiō is to be ascribed.

A difference betweene the Peripatericks and Physitians

Aristotle in his second booke de *Anima*, and in his booke de *sensu & sensibili* doth affirme that the externall Nose which is conspicuous in the face, is the chiefe Organ of Smelling; wherein he conceiueth there is a couer like a value which is neuer opened, but by inspiration, whence it is that wee haue no Sense or perception of odours but when we inspire.

Galen demonstration

Galen in his booke de *odocratus Organo* doth in the third and fourth whole chapters vehemently inueighe against *Aristotle* where hee teacheth that indeede the externall Nose doth something conferre vnto this sense of smelling, but the chiefe Organ thereof is within the skull; And for the confirmation of this conceite, he vseth an elegant and inuincible demonstration from the enumeration of the seuerall parts of the Nose. For, neither saith he can the bones, nor the gystles, nor the membrane, nor the nerue dilated through the membrane be the true organ of the Smell, and therefore no externall part of the Nose can bee. As for the bones and gystles they are so farre from hauing the Sense of smelling that they haue not so much as the faculty of Touching allotted vnto them: they therefore are farre vnfit for the performance of this function. Again, euery *organon* or organ ought to communicate in nature & conformation with the sensible thing; that so the organ might be more easily altered by it. But nothing is agreeable to the nature of Odours, but that which is vaporous: betwixt the nature thereof and that of bones & gystles, there is very great distance.

As for the membrane which inuesteth the Nose; it is indeed endowed with most exquisite Sense of Touching, yet it is too crasse and thicke, for the reception of such subtile objects as odours are. And beside, this membrane or coate is also common to the tongue and

and the Palate and mouth, but in those parts it hath no Sense of odours. Again if this membrane were the true instrument of Smelling, then it should continually perceiue the appulsion or beating of the odours; but there is no preception of odours, except when we do inspire; for though you fill the Nose full with Muske or Ambergreese or other odoriferous bodyes; yea though you should annoynt the whole membrane with sweete oyles, yet you shall haue no perception of odours except you draw in the Ayre by inspiration; wherefore we conclude that the principall Organ of Smelling is not placed in the bone or grystle or membrane, or any other part of the externall Nose.

The membrane is not the instrument of Smelling.

As concerning that couer or value (whereof this great Philosopher dreamed) which is open when wee draw in our breath, and shutteth when wee hold our breath, *Galen* doth in no sort acknowledge it in the aboue named places, neither will any well skilled in Anatomy admit of it. But yet put the case that there be such a value in the interiour part of the nostrils, and that it doth sometimes open it selfe to make a passage for the ayre and vapors which we draw in, and that it shuts againe when wee cease our inspiration, then surely the motion of this couer must either be animall or naturall, or violent. That it is Animall or voluntary, no man will say, because there is no neede of such a value vnto animall motion. And beside, all animall motion is at the command and in the gouernment of the soule, and obedient vnto our will and appetite, but this value is neuer opened but when we draw in the Ayre. Moreouer, the immediate instrument of voluntary motion is a muscle, but there are no muscles to be found in the depth of the cavity of the nostrils.

That there is no value Reason.

Neither is this motion Naturall as is the motion of the values of the heart. For the heart is perpetually mooued, and that motion performed by it owne instinct and not by our will.

If you thinke it bee violent because it is forced by the inspired Ayre, then giue eare vnto *Galen*'s obseruation ouerthrowing this conceite. For, saith he, if you shall force either much ayre or any liquour into the nose through a pipe and hold your breath, why is not the value opened if there be any such extent, and why should there not be a perception of those odours in the Nose? If the Peripatetickes shall insist, and retort our owne argument, and fight against vs with our owne weapons, and say, if the Mammillary processes bee the principall Organ of Smelling, why doth not sweete Ayre being driuen with force and violence through a pipe moue the Sense?

Objection, Solution.

Galen answereth, that the aire being blowne and forced through a pipe, if wee hold our breath doth neuer reach vnto the Braine, because all partes of the Braine are full of Ayre when the Braine is contracted by expiration; but when the Braine is dilated by his inbred power all the spaces are enlarged, and so for the auoiding of vacuitie are filled with inspired aire. The aire therefore cannot attaine vnto the processes and Ventricles of the Braine but onely by inspiration, because except the Organs be dilated, how shall the aire passe through those pores which bee already full of ayre? Now if aire cannot be brought but by Inspiration vnto the Mammillary processes, then surely cannot the species or kindes of odours: for as the character and quality of the sound cannot bee carried vnto the Organ of hearing but by the meanes of the intermediate ayre, no more can the qualitie of odours attaine vnto the organ of Smelling. Let *Aristotle* therefore patronize his owne opinion himselfe.

Wee with *Galen* and the Physitians do resolute that the principall organ of the smell is seated within the Scull and a portion of the Braine, namely, those processes and two bunching productions which are like to the Nipples of a womans pap, and doth reside or rest vpon the highest bone of the Nosethrils.

The true Organ of smelling.

And this hath *Hippocrates* bewrayed in his Booke *περί ἀρτηρίας*, where he saith, That the Braine doth smell the odour of dry things together with the aire, drawing the same thorough two cartilagineous or gristly bodies. And to him doth *Galen* beare witnesse in his booke *De Odoratus Organo*, in his eight booke *de vsu partium*, and in his first booke *De Sympt. Causis*. And lastly sound reasons doe also euince this our opinion. First, that part is to bee accounted the principall which hath a peculiar substance, figure and composition. Witnesse *Galen* in his sixt booke *de Placitis Hippocratis & Platonis*. But the processes amongst all the parts of the nose haue a peculiar nature, figure and composition, which you cannot finde in any of the other. But the Bones, Grystles and Membranes are euery where alike. Wherefore the principall cause of this action of Smelling is to be ascribed to the Mammillary processes.

The Mammillary processes. Authoritie.

Reasons proving this first.

Again, there is no part in the nose which can be altered by odors, but these processes being

Reason being

being full of spirits doe with facility receiue the species of odours, & because they are neere of a kin to the Nerues, they haue a kinde of Notion of that qualitie which they perceiue.

Auerroes
disproouing
Galen.
First reason

Auerroes being a bitter enemy to Physitians in the defence of *Aristotle* endeauoureth to ouerthrow this opinion of *Galen* but with very easie Engines. If (saith he) the Mammillary processes were the organs of Smelling, then the odour of those things which are bruised in the mouth would be smelt when the Nofethrils were obstructed and shut, because there is a manifest passage for the aire open from the mouth and palate vnto those processes.

Second.

Moreouer, the odour of those meates which are contained in the Stomack would be perceived, for there do certaine vapours expire there-from vnto the Braine, during the whole time of the concoction. And lastly, such creatures as wanted these processes would also want the sense of Smelling. But I thinke we may fully satisfie these obiections on this manner. First, although there be a way open out of the mouth into these processes, yet notwithstanding there is not any perception when the nofethrils are shut, because the odours should first be offered vnto the Nofethrils and there bee prepared; without the nofethrils therefore there can be no perception of odours, and yet it doth not follow that the Nofethrils therefore are the principall organ of this Sense. Euen as without the watery humour no vision can be made, and yet no man will say that it is the principall Organ of Sight.

Third.
Galen answer.

But besides this, there is another reason why when our noses bee shut, those things which are chewed in the mouth and are contained in the stomacke are not smelt, to wit, because the odour being as it were drowned and strangled with the excessiue humiditie of the mouth cannot make shew of it selfe, nor imprint his nature species and forme in the Sense of Smelling. For odour is (as *Aristotle* himselfe in his second Booke *de anima* affirmeth) of a dry thing, as a Sapor of a moyst thing. So those which are troubled with the *Coryza* or a distillation out of the head into the nose which wee call the *pose*, doe not perceive the formes of odours.

Why we doe
not smell that
which is in
our mouth and
Stomacke.

Moreouer, that vapour which is brought from the Stomacke vnto the Braine is not perceived by the smell: because such vapours are too familiar and too well acquainted with the Braine, so that no alteration can be made by them. In like manner those which vse to eate much garlicke haue no sense of their owne stinking breath.

As for *Auerroes* his last obiection, that many creatures wanting these processes, yet do perceive the fauour of odours, is not any whit repugnant vnto *Galen*. For he speaketh onely of perfect creatures, and not of imperfect, which as they can stand without bones and liue without Lungs, so there is no reason but they may respire and breathe without nofethrils or these Mammillary processes.

The conclusion.

Wee conclude therefore that those two swelling mammillary processes are by good right accounted the principall organ of smelling, yet notwithstanding wee affirme that there can be no perception of odours without the helpe of the nofethrils and the spongy bone; And thus much of the Sense of Smelling. Now we proceede vnto the Taste.

QUEST. LV.

Whether Taste be the chiefe action of the Tongue.

ALbe it be commonly knowne that to Taste is an action of the Tongue, yet it shall not be amisse to make this truth somewhat more manifest, for the Tongue is ordained for many vses. First to articulate the voyce. Secondly, for mastication or chewing, because it containeth the meate within the mouth, and rowl-eth it vnder the mill-stones of the Teeth. Thirdly, for the Taste and dignotion or perception of saviours. The question therefore shall be, which of all these is the principall action for which Nature ordained this instrument, because we assigne vnto one part but one principall action. That therefore is called the principall action for which the Tongue was primarily instituted by Nature. And that Action is primary which is most necessary, the rule of Nature being first of all to provide for the necessity of the creature. The action therefore which is most necessary is also the principall action.

The diuers
actions of the
tongue.

Which action
is principall.

Speech is not
the principall
action of the
tongue.

I know well what great vse wee haue of speech, and how miserable the life of a dumbe manis, yet because other actions are more necessary, therefore wee cannot beleue that speech was the principall end for which Nature ordayned this Organ. Now that other functions are more necessary then speech we neede not to doubt, because those are absolutely necessary

necessary to life, this onely to better life. That the other functions are absolutely necessary, for the conseruation of life is hence manifest, because brute beasts cannot liue without them as they doe without speech.

But amongst those other functions, which is the most necessary, is harder to discern, yet to say truly mastication is not an action of the Tongue, and therefore wee will not stand in this place to dispute the necessity of it. For it is an instrument of mastication but by accident, as it rowleth the meate vnder the Teeth that chew it. But a principall action belongeth not to a part by accident, but by and of it selfe. Againe, it were absurd, to say that the principall action of so noble a member, did but helpe the Teeth to chaw the meate. Adde hereto that mastication or chewing it not so necessary to life as Tasting is, for Infants doe swallow their meate without chewing, and so doe most Fishes, as *Aristotle* remembreth in the eleuenth chapter of his booke *de partibus Animalium*, but without Taste the creature cannot liue. Not that if their Taste be lost, they must presently perish, (for it was a custome among the Ancients for blasphemie to cut out mens Tongues and yet they died not) but because all creatures taking delight in some one kinde of food or other, when the sense of pleasure is taken away, they abstaine from those meates, or take but little and so pine away to death. And this is the opinion of other men concerning the necessitie of the Taste. I, saith *Placentinus*, doe rather thinke it therefore necessary, because when it is lost the creature taketh all meates indifferently, and by that meanes is often extinguished by poyson in steede of nourishment. Seeing therefore that perpetuall nutrition is absolutely necessary vnto life, therefore Nature ordained this Sense, to take the assay, which was fit should be very exquisite, because the Lord it serueth, which is Nutrition, was the principall act for which the creature was ordained.

Wee conclude therefore that of all the actions of the Tongue the Taste is the chiefe, and that the rest are but seruants and attendants there-vnto, especially Mastication.

Not Mastication.
Reasons why

The necessity of the Taste.
An old kind of punishment of Blasphemy

The reason of the necessitie of the taste.

QUEST. LVI.

Whether the Taste differ from the Touch.

THE Taste is one of the fine externall Senses, whereby wee discern the differences of saviours. This Sense hath great affinity with the Sense of Touching, in so much that some haue made no distinction betweene them, but haue placed the Taste vnder the Touch, as the species vnder the Genus, for which they haue not onely *Aristotles* authority, but very strong reason. The authorities they produce are these. *Aristotle* in the second Chapter of his Booke *de Sensu et sensibili* saith, that the Taste is a kinde of Touching. Againe, in many places he affirmeth that Taste hath a kinde of Touching, as in the 4. chapter of the Booke before named. In the 64 Text of his third booke *de anima*. In the 17 chap. of his 2 Booke *de partibus animalium* and in infinite other places. But these authorities seeme not to be of any great consequence, because the same *Aristotle* hath oftentimes affirmed that all sense is a kinde of Touching; from whence it should as well follow that there is but one Sense, that is, the Touch, then which nothing can be more absurd. Wee must not therefore conclude that the Taste and the Touch are all one, because *Aristotle* saith, that the Taste is a kinde of Touch.

What Taste is and how neere a kin to touch

Aristotle. authorities.

It seemeth to mee notwithstanding that there is something in it, why particularly in treating in diuers places concerning the Taste, hee calleth it rather a Touch, then the other Senses, especially in his proper Treatise of this Sense; whereas hee giueth no such attribute to any other of the Senses. For in his chapter *de visu* hee doth not say that Seeing is a kinde of Touch, nor shall you finde in the Chapters of Hearing and of Smelling any such matter. Further, this opinion is confirmed by *Aristotles* argument, because hee ascribeth the same object to both these Senses; for in the very beginning of his Chapter *de Gustu*, that which is Gustable or fit to be Tasted, is also Tangible and fit to be Touched. And comparing the Taste with the Touch, he saith that there is the very same reason and nature of them both. Yea, that they differ nothing one from another. And in the 28. Text of his second booke *de Anima*, he speaking of set purpose auoucheth the very same, for he sayth not onely that which is Gustable is also Tangible, but also that the Touch is the Sense of Aliment. And about the end of the same text expressly naming the object of Taste, he saith, that a Savour is one of those objects which are perceived by Touching. And in the 63. text of the

Called into question.

And expounded.

same

same booke more playnly thus; *Wherefore the Taste it selfe is a kinde of Touching, for it is the Sense of alimens, now alimens is a body which is perceined by the Touch.*

If therefore Tasting and Touching haue one and the same obiekt, surely they are one and the same Sense. As from the plurality and diuersity of obieks, the plurality and diuersity of the Senses is gathered, so from an vnity and Identity of the obiekt it must needes be there should follow also an vnity and Identity of the Sense.

They adde also an argument gathered out of *Aristotle* in the beginning of his Chapter *de Gustu*, on this manner. *Taste and Touching doe equally perceine that which is moyst, yea moysture though it be insipide (some say) may be discerned by the Taste.* Seeing therefore the obiekt of the Touch may be perceined by the Taste, and the obiekt of the Taste, reciprocally by the Touch, they must be esteemed distinct Senses.

Finally, they adde out of *Aristotle* that in the 23. text of his second booke *De anima*, and in the 68. text of the third booke he saith, that the Touch onely is necessary for the creature. And againe, in the fourth chapter of his booke *de sensu & sensili*, as also in the last chapter saue one of the third booke *de anima* hee saith, that a creature cannot bee without the Taste; wherefore say they, *Aristotle* thought that the Taste and the Touch were both one, otherwise there should be a repugnancie betwixt these two places.

All these particular instances out of *Aristotle* doe at the first blush seeme to prooue that he was of their mind. But if we looke somewhat more narrowly into them we shall finde that there can be no such thing gathered from *Aristotle* by good and lawfull consequence.

Answer to
Aristotle's au-
thorities.

To the first
instance.

For first whereas he saith that the Taste is a kinde of Touch, it is nothing else but to demonstrate the affinity betwixt these two Senses; for if he had meant that the Taste and the Touch did not differ in *specie*, hee would neuer haue said that *Gustus* is *Tactus* quidam, but simply and plainly *Gustus* is *Tactus*, hee should not haue said that Taste is a kinde of Touch, but that Taste is a Touch. Neither are we to wonder why *Aristotle* speaks in this manner rather of this Sense then of any other. Is it not because none of the other Senses haue any such acquaintance or familiarity with the Touch as the Taste hath?

The affinity
betwixt the
Taste and the
Touch.

Consider first that the Taste as also the Touch is made without a *Medium*, so are not the rest of the Senses. The reason is, because as well in the Taste as in the Touch the obiekt must touch the Organ, so that their extreme parts are contiguous one which another. Hence it is that the Gustable obiekt being about that which Tasteth, maketh Gustation, whereas in other Senses there is no comprehension of the obiekt by the Organ sauing by the interposition or mediation of a *Medium* or middle body.

Answer to the
second in-
stance.

Finally the obiekt of the Taste is more endowed with tactile qualities then the obieks of the rest of the Senses as being more corporeall, materiall, earthy, and to speake in a word, correspondent or answerable to the Tactile obiekt, so that *Aristotle* might well say, that that which was Gustable was a kinde of Tangible. Seeing therefore this Sense of Tasting hath so many more conditions concurring with the Touch then the other Senses, it was not without cause that *Aristotle* so often compared the Taste and the Touch, and in a manner of speech confounded them, but was more sparing in the collation of the Touch with the other Senses. And hence wee may shape an answer to the second authority, for he doth not say simply *Gustabile est Tangibile*, but *Gustabile est quoddam Tangibile*, adding a conditionall particle whereby he would intimate that there was a great vicinity or neighborhood betwixt these two kinds of obieks, yet notwithstanding that they did so differ, that they did not fall vnder one and the same Sense.

To the third.

First Answer

The third argument is weighty and difficult; for without any condition or limitation he saith, that a Sapor is perceined by the Touch, and that the Touch is the sense of Aliment; notwithstanding wee answer that *Aristotle* doth not make a Sapor as it is a qualitie properly Gustable, but as it is in a gustable body. For this body is indeede perceined by the Touch, not as it is Gustable, but in respect that beside the Sapor it hath also many Tangible or Tactile qualities.

The last

Add moreover, that the word *χυμὸς* which *Aristotle* vseth, doth not onely signify a Sapor but also a iuice and humor indued with a Sapor, whence the Physitians call those meates *ευχύμους*, not which are well-tasted but which yeelde a profitable and Alimentarie blood vnto the bodie: againe on the contrary they call those meates *κακοχύμους* which yeelde a bad and vicious iuice, and that disease is called *κακοχύμια*, when the body aboundeth with euill and vicious nourishment. Wee are therefore to beleue that *Aristotle* is thus to bee vnderstood, because so oftentimes he testifies that Sapor hath his residence or being in humidity, or that which is humid and moyst.

I might also say that *Aristotle* speaketh in that place of that Savour which nourisheth. Now a Savour as it is a Gustable quality doth not nourish, because that which is incorporeall cannot be turned into a body, but that which nourisheth must of necessity be converted into the body that is nourished. It is therefore no question but that when *Aristotle* spake of a Savor hee meant it *de corpore Sapido*, that is, of a body which was not without Savors or Tastes. And indeede a Sapid body may nourish. So saith *Avicen*, that which hath a good Taste doth also nourish, not that the Savor or Taste doth nourish, but the substance wherein the Sapor doth consist.

Third answer.

Avicen

On this manner also is *Aristotle* to be expounded, where hee saith, that the Touch is the Sense of aliment, for he doth not meane that it falleth vnder the Touch and vnder the Taste after the same manner and in the same respect: but vnder the Touch in regarde of the Tactile qualities, vnder the Taste in regard of the Sapor. It is as much therefore as if hee said, *Because the Aliment as it is a body cannot be found without Tactile qualities, the Touch indeede perceiveth these qualities, but it perceiveth not the Sapor as it is a Sapor.* And therefore in the 63 Text of his third Booke *de Anima*, after hee hath sayd that the Touch is the Sense of Aliment hee explaineth himselfe after this manner, *But the aliment is a Bodie which is perceived by the Touch.*

To the fourth

Seeing therefore the Aliment is a bodie, it must have both Tactile and gustile qualities, and therefore may be truly called the object both of the Taste and of the Touch, yet is it the object of neither Sense as it is an Aliment, but of the touch as it is moist and dry, hard and soft: of the Taste, as it is sweete, bitter, salt and the like.

As for the reason which they alledge out of *Aristotle*, I hold it to be of no weight, because *Aristotle* had no such intention; yet we may grant that moisture is perceived by the Taste not as it is moisture, but as it is sapid: and that insapide moisture or moisture without Taste may be discerned by the Sense of Tasting, that I utterly deny.

To the fifth

Concerning the necessity, that which they vrge is meerely friuolous, for *Aristotle* supponeth that the Touch is simply necessary so that the creature without it cannot subsist: but the Taste is necessary in respect of the Touch, because it is a kinde of Touching: yet we doe not denie but that the Taste also is necessary *secundum quid*, as we say in the Schooles, that is, not of it selfe, but because the creature wanteth nourishment. It doth not therefore follow that either the Taste and the Touch should be both one, or else that an imputation should be cast vpon *Aristotle* for contradicting himselfe.

To the sixth

It may be also objected, that because both the Taste and the Touch are together in one and the same Tongue, that therefore they shall be one and the same Sense. But the consequence is not good, for there is no organ of Sense, which beside this proper Facultie of Sensation is not also furnished with the Sense of Touching. But because the Sense of Tasting is not alwayes found where Touching is, and where it is found there is no other Faculty of Sensation: I conclude that not onely all the other Senses but the Taste also is a distinct and different Sense from the Touch.

Objections

Solution

QUEST. LVII.

Of the object of Tasting.

THe object of the Taste saith *Aristotle* in the fourth Chapter of his Booke *de Sensu & sensibili*, is not onely more evident and manifest vnto vs then the Odours are, but also then other Sensible Objects. The reason wee may giue out of the same place of *Aristotle*, because the Taste is a kinde of Touching, which Sense in a man is more perfect then all the rest:

The object of Taste is more evident then of other senses and why.

Now the Object of the Taste is that which is *Gustabile* or *Gustile*, which word signifieth two things, to wit, Savour or qualitie and affection seated in a sapide body, and the body it selfe wherein the Sapor is. But the Sapor is the proper and adequated or proportionable object of the Taste, and therefore *Aristotle* appropriateth the word *Gustabile* to the Sapor. As (sayth he) *visibile est color, sic Gustabile est sapor*, as that which is visible is a Colour, so that which is Gustable is a Sapor: as if he should say, that a Gustable body is no way Gustile or to be Tasted, but onely in respect of his Sapor. Yea hee oftentimes puts *Gustabile* for *Sapor*, the reason is because a Sapor hath no existence of it selfe, neyther can it moue the Sense but hath all his being and essence in the mixt body. That ther-

2. significations of Gustabile.

fore

fore which he calleth *Gustabile* is a mixt body, which in respect of that quality which is called a Savour is Gustile or may bee Tasted. Not that a Savour doeth by it selfe mooue the Sense, but because it cannot subsist without the mixt body, for considered euen without the mixt body it may be said to be the object of Taste, because it is it alone in the mixt body which mooueth the Sense.

QUEST. LVIII.

Of the matter of Sapours.

What a savour
is.
2. kinds of
first qualities.



Savour is a quality arising out of the first qualities, which alone by it selfe is able to mooue the Taste. Now the first qualities are of two sorts: some Actiue, as heate and cold; others Passiue, as moysture and drought. Out of the Actiue qualities the Savour hath his Efficient cause, to wit, heate; out of the Passiue his Materiall cause, to wit, Moysture. But least any man should wonder why we make moysture which is nothing else but an incorporeall quality to bee the matter of Sapours: We answer, that we vnderstand humidity not in the abstract but in the concrete. So that haply it were more proper to say *humidum* then *humiditas*, for to say truth, a Savour is not made onely of humidity, but of humidity ioyned with siccity, yet so that the humidity is predominant.

Sapours are
not made of
simple humidity.

Wherefore *Aristotle* sayth that a Savour dwelleth in that which is moist, as an odour doth in that which is dry; yet he doth not name humidity alone, nor simple siccity, but both conioyned, and therefore he rather expresseth himselfe by *humidum* and *Siccum* then by *humiditas* and *siccitas*: so that in the one the moysture preuaileth ouer siccity, in the other the siccity ouer moysture. For thus much doth *Aristotle* intimate in his Booke *de sensu & sensibili*, where he saith that the vniuersall nature of Savour is, that it is a passion of the Sense of Tasting made by that which is earthy, dry, in that which is moyst. Wherefore humidity being predominant in an earthy siccity is properly the matter of Sapors.

1. Obiection

It may be objected, if in Sapours the humidity must preuaile ouer the siccity, then those bodies wherein the siccity preuailes ouer the humidity should bee insipide and without Taste. Now there are many in which the siccity is predominant, as Ashes, Pepper, Ginger and such like, which notwithstanding haue a very sharpe and quicke Taste. Adde moreouer that if that were true, then Sapours should not properly belong vnto Aliments; for *Aristotle* sayeth in the 28. Text of his third Booke *de anima*, that hunger is an appetite of that which is hot and dry. An Aliment therefore is not moyst but hotte and dry, because it appealeth hunger. Seeing therefore all men confesse that Sapours doe properly belong to Aliments, it should seeme also that Sapors haue their residence not in moysture but in siccity.

2. Obiection.

We answer, that an Actiue Savour, that is, such a Savour which is instantly fitte to mooue the Taste must necessarily bee in moysture. That which they obiekt of Pepper, Ashes and such like, wee answer on this manner. Wee grant that of themselues they are insipide and haue no Savour but that which is potentiall, for they doe not Taste till they be chewed, and that is by accident: when as that humour which perpetually remaineth in the mouth and the tongue, prouoketh or produceth their potentiall vertue into Act, but because siccity is in them predominant, therefore they yeeld a sharpe and quicke Taste.

Solution 2.
2. kinds of
Aliments.

That which they adde concerning Aliment is easily answered, for there are two kinds of Aliments; one which satisfieth hunger, another which satisfieth thirst. That which satisfieth thirst is exceeding moyst, and in respect of it that which satisfieth hunger may bee called dry, although it doe not follow that it should simply be dry, yea it is necessary that it should haue so much moysture as the Sense of Tasting doth require otherwise it could not satisfie hunger.

Finally, whatsoever mooueth the Taste must of necessitie haue an inward moysture wherein it is steeped, although it hath no outward, the reason is, that it may melt and diffuse it selfe through the organ of the Sense, for those things that are hard and cannot bee dissolued cannot mooue the Sense of Tasting; as wee may conceiue by a rough and torried tongue such as we see is chapped and blacke in violent Feuers, which cannot make any certaine estimation of the differences of Sapors.

QUEST. LIX.
Of the efficient cause of Sapors.



F the passive qualities therefore moysture preuailing ouer Siccity is the matter of Sapors. Of the active qualities they haue heate for their efficient cause. For as the simple and pure Elements are of themselves without sapor or odor, so also in the mixt body no such thing would result out of them if euery Element should reserve his owne quality to himself; and therefore there is neede of heate to draw out the Sapors out of the concoction of the humidity and Siccity, by which concoction these two are fitly mixed one with the other, neither is it reason that any man should substitute cold to this office, for daily experience teacheth vs that fruites when they are frozen, as Apples, doe vtterly loose their taste; yea although they be thawed and resume their former heate their tastes do not returne. So that cold is so farre from being the efficient cause of Taste, that rather it doth vtterly destroy it. Adde hereto that no fruite attaineth his native Tast till it grow ripe, now this ripening is made by heate. It remaineth therefore that heate in as much as it concocteth humidity, and accomplisheth perfect mixtion, is the true and onely efficient cause of Sapors.

Heate is the efficient cause of Sapor.

How that is. Cold cannot be.

Why frozen fruites loose their Taste?

QUEST. LX.

Of the number and order of Sapors.



Aristotle in the 4. chapter of his booke *de sensu & sensili* going about to recite the diuers kinds of Tasts compareth them with colours, not because there is any great affinity betwixt them, but because there is in it as many of the one kinde as of the other, and he concludeth them both vnder the number of seuen. Some say there are eight kinds of Sapors, and Pliny in the 21. chapter of his 15. booke, reckons vp thirteen. We with Aristotle will rather reduce them vnto the number of seuen, because, as there may be (and indeed there are) infinite varieties of mixtion, so we might draw out of them infinite differences of Sapor, if it were possible accurately to nuber them; for nothing is so sure as that the differences of Sapors doe arise from the multiplicity of mixtion; for example, out of that wherein heate and moysture are abundant, a sweet Sapor; out of that that is hote and dry, a bitter and salt Sapor, and so in the rest, as this or that quality hath greater or lesse rule in the mixt body, yet alwayes moysture must haue the first place.

How many kinds of Sapor.

As many as of mixtures.

An instance of this we haue in a place of Galen, in the sixth, seventh and eight chapters of his fourth booke *de simplicium medicamentorum facultatibus*. The fruites of trees (saith he) that appeare to vs to be sweet when they be ripe, are soure when they are yong, & dry of consistence, but in processe of time they become moyst, and their sowrnes turnes into sharpenesse, which sharpenesse they loose by degrees as they grow ripe and at length become sweet.

An elegant place of Galen, concerning Sapor.

Among these Sapors; Salt and Bitter are contrary to sweete, because being vnder the same kinde there is the greatest distance betwixt them, Aristotle hauing a respect to white and blacke calleth them *privatiues*: and that not without good cause, for although being vnder the same kinde they differ most one from another, yet they cannot be truly said to be contraries: for sweetnesse is generated in a subiect that is fulfilled with heate and moysture, but salt and bitter are in a subiect which is hot yet very dry, and therefore the sweet Sapor nourisheth more then the rest, yea we thinke that all other Sapors doe nourish onely by reason of their sweetnesse which lurketh in the secret bowels of the sapide body, although by the Taste it cannot be so manifestly perceived. For all nourishment must be conuerted into bloode that so it may become a fit nourishment vnto the parts, but laudable and good blood is hot & moyst and sweet to Taste to. That Sapor therefore which hath the greatest Analogy and affinity with bloode is fittest to nourish, and such is the sweet Taste.

Salt and bitter are contrary to sweet.

Other Sapours which haue no sweetnesse at all in them are altogether vnfit for nourishment.

There are some which thinke that sweet and bitter are not the extreame Sapors; grounding themselves vpon Plato in *Timaeo*, because (say they) those Sapors are to be accounted extreames which come neere vnto the first qualities. But neyther sweete nor bitter are such, but *styptrick* or *binding* and *keene*, for the keene taste or byting, such as is in Pepper.

per resulteth out of a high degree of heate. The other which bindeth and contracteth the Tongue ariseth from extreme cold.

Againe, those objects that are extreame doe hurt and offend the instrument; now sweet doth not hurt but refresheth it, yea it conserveth the temper thereof by an acceptable pleasure and delight. Another Reason may be, why sweet is not an extreme Taste, because from *sowre* to *keene* the passage is by *sweet*. So that whatsoeuer is *keene* or biting when it is ripe, and *sowre* when it is greene, will haue a kinde of sweetnesse in it before it come to his perfection. Now in qualities the transition is by the mediate or meane qualities, not by the extreame. It is therefore to be concluded, that not *sweete* and *bitter* but *sowre* and *keene* are the extreame Sapors.

That sweet
and bitter are
not extreame
Sapors.
Arguments.
Refuted.

But although we must needs confesse that these Arguments haue some life and strength in them, yet we presume that *Aristotles* opinion may well be maintained. It is true indeed, that if you consider Sapors according to their originall, that is, as they result out of the first qualities, our aduersaries haue concluded well. But if you regard Sapors, without respect vnto their originall and simply as they are Sapors, that is, naked qualities which moue the Taste, then our Aduersaries are in the wrong.

Plato expounded.

Aristotle defended.

It may well be, that *Plato* vnderstood the matter on this manner, because he doth especially attend to the temper of the body in which the Sapors are, but this is not the proper contemplation of Sapors. *Aristotle* who of purpose disputed concerning Sapors vnderstood them according to their proper Nature, to wit, as they moue the Taste: for a sweet and a bitter Sapor do more and affect the Sense after the most contrary manner. So colours are not to be considered as they are nearer or further off, to or from the first qualities, but as they affect the Sight, and in this respect white and blacke are called extreame and contrary colours, because they affect the sight after a most contrary manner, for *white* dissipateth the Sight, *blacke* congregateth and vnitheth it.

Why Sapors
are called ex-
treame.

Answer to the
second reason.

To the third.

Whereas they say that the keene and Stipticke Sapos do hurt the organ, they are deceived if they meane it in respect that they are Sapors; for the truth is, that the Offence commeth from the first qualities, to which those Tastes are too neere Neighbours. And this is the reason also why the passage is from *sowre* to *keene* by *sweet*, because those qualities are so changed in the mixt body, that after *sowre* doth succeed *sweet*, and after *sweet* *keene* or *hot*. Their consequence would follow, if the *sowre* Taste should engender sweet, and sweet should engender that that is keene and hot, but there is no such matter: for who did euer say that the second qualities did arise one out of another? For they proceed not so much from their first qualities as from the condition of the matter. We conclude therefore, that because the sweet and bitter Tastes as they are Tastes or Sapors, do after a most contrary manner affect the Sense of Tasting, that therefore these are the extreame Sapors.

Second qual-
ities arise not
one from ano-
ther.

How many
intermediate
Sapours.

Hauiug thus resolued which Sapors are extreame, let vs now a little consider what are the intermediate, which with *Aristotle* we reckon six, *Fat*, *Salt*, *Keene*, *Sowre*, *Sharpe* and *Tare*, which in Latine are called *Pinguis*, *Salsus*, *Acris*, *Acerbus*, *Acutus*, and *Acidus*.

Why they are
infinite.

I list not to oppose *Pliny* or any man else that hath bene pleased to make more differences of Sapors, these are those that are most manifest, and therefore *Aristotle* contented himselfe with them, the rest being very obscure or at least not knowne to such as this our labour shall concerne. Thus much onely we will admonish you of, that all the variety of Tastes beside those we haue accounted, do arise from the innumerable variety of mixtions, from the different constitutions of the organ, as also from some secret and vknown instincts which do reside in particular bodyes, whereof to say truth we can giue no reason at all.

All Sapours
cannot be
defined.

Wherefore because the Sapors themselves are infinite, their proportion very diuers, and their causes so transcendent, it is not possible to make any definition or description of them to any purpose. Who can deny but that some creatures, yea some men doe vehemently desire bitter things and abhorre that which is sweet: are bitter things therefore sweet to the one and sweet things bitter to the other? You will say no, because the difference ariseth from the diuersity of his Temperament that Tastes it. I confesse it, but seeing there are almost so many diuers Temperaments as there are *indiuiduals* or particular creatures in the world, I would aske the question whether it be possible that so many different kinds of Sapors, may be reckoned or deduced from them? By no means: no more is it possible to define them.

A definition
of sweet and
bitter.

Wherefore if you looke into the vulgar descriptions of Sapors you shall finde them full of errors. That (say they) is *sweete* that doth affect the Sense best, that is *bitter* which affects it worst.

Neither

Neither is true, for if that which is bitter did affect the Sense worst, no man would desire it, no man would take pleasure in it; for that which peruerteth the harmony of the Sense, may in some respect at least be pleasant vnto him, but that which doth affect the Sense worst must needs make the instrument to iarre; and yet we know that many men (not to speake of other creatures) doe wonderfully delight and vehemently long after those things which are bitter.

Againe, if sweet were that which affecteth the Sense best, then should it please all men, yea all creatures, for that which affecteth the Sense best we should most reioyce in, which notwithstanding we finde to be contrary oftentimes in our selues, when nothing is more irksome vnto vs then that which is sweet and luscious.

But some men may aske me (if I doe not like these definitions) how I would haue sweet and bitter defined. I answer (as I said before) that they cannot bee defined; for accidents doe not fall vnder definition, especially second qualities which are more accidentary then the first: and therefore I thinke they cannot be so much as described, vnlesse you will take that for a description which is most common, and when there hapneth any exception it shall be said (and that more truly then they are aware) that it happens by accident, that is to say, not because the Taste doth not agree with a description, but because there is some fault in the Organ which doth not perceiue the Sapor as it is.

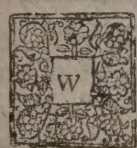
Well, we will confesse that these Sapor being the extreames, may fall vnder some such rude description as is before exhibited; but whose penill can draw so fine a line as to describe the intermediate Tastes? Shall we make one for all, and say that those are intermediate Sapor which affect the Taste after a middle manner?

Surely this definition had not neede to be scanned in the Schooles, being made at random or at large without any causes or signes of causes therein.

Much better it is in my opinion to note them out by examples or instances, as *Galen* hath wisely done in the eight and ninth Chapters of his fourth Booke *de medicam. facult.* A sweet Sapor therefore doth consist in a matter abundantly moyst and moderately hot: as are Figges, Hony, ripe Grapes, sweet and mellow Apples and suchlike. The bitter Sapor resideth in a very crasse and thicke matter; hot indeed but moderately moyst, yea rather drye as Wormwood, Gall, Aloes and suchlike. A fat Sapor consisteth in a thin matter and ayry, which also is temperate in the first qualities as is Seame, Marrow, Oyle, Milke, Butter and suchlike. A salt Sapor consisteth in a dry matter, as in Salt, Ashes, Gun-powder and the like. A keene Sapor is in a substance whose parts are thin and subtile, yet moyst and the temper hot; such a taste is in Garlick, Onions, Raddish and the like. A sowre taste which also they call stipticke and *Sapor ponticus* (but I knowe not why) is in a crasse and cold matter, as in vnripe Apples and Berries or suchlike. An acute or byting Sapor is when the parts are thin subtile, dry and hot, as Pepper and Ginger. The sharpe is in thin parts but cold, as in Vineger, Lemons, oyle of Vitrioll and suchlike. Finally, you may with me obserue that no man; (for ought I know) hath hitherto sufficiently described these maister Sapor, nay not so much as giuen them apt and fit names, the confusion wherof do make the discourse of them tedious to the Reader. Onely *Galen* hath chalked out a faire way, wherein if we carefully insist, happily this labyrinth may at length be troden out. We conclude therefore, that if it be impossible rightly to define these heads, hard to describe them, very difficult to giue them proper names, what an infinite taske were it to vndertake an exact discourse concerning all the particular differences of Sapor?

QVEST. LXI.

Of the Medium or Meane of Tasting.



WE are againe false into a hard and intricate way wherein none of the Ancients or of the new writers haue beaten out a pathe vnto vs, and that is concerning the medium of Tasting. *Aristotle* was in a great suspence concerning the medium of Touching, neither did he determine any thing thereof. In like manner concerning this of Tasting he hath vtterly forsaken vs. And I wonder much (saith *Placentinus*) that amongst all the Philosophers there is not one that hath insisted in this disquisition to finde out the truth; but those that haue particularly made Tractates of this Sense haue notwithstanding balked this argument, not considering that in euery Sense there be three things especially to be stood vpon, the Object, the Medium and the Organ.

Philosophers
faile therein.
Arist. toucht
vpon it.

Concerning the object and the Organ all men do agree, and the cry is vniforme and current. But for the *Medium* there all the whole field is at a losse. Haply the difficulty of the Disquisition did affright them, for otherwise the contemplation is not vnpleasant. *Aristotle* toucht vpon it in the 101. Text of his second Booke *de anima* where he saith, That the Taste hath no external *Medium* because it is a kind of *Touching* which it selfe hath no such *Medium*. Beside this, he hath nothing of this matter; notwithstanding we will aduenture to put forth our selues vnder the censure of this carping age, which if we shall not satisfie, yet

Si non datur ultra, est aliquid prodire tenus.

If further forth we cannot go,
Yet something 'tis the way to show.

And haply he that comes after, as it is in new discoueries, may not repent him that we haue founded the Shore.

The taste needeth no *medium*.

First therefore we enquire whether this Sense doe neede a *Medium* or no. To speake ingenuously and as I thinke (saith *Placentinus*) it hath no absolute neede, neither shall it be materiall to distinguish between an externall and an internal *medium*, because we thinke that neither is necessary seeing the Taste which is a kind of Touch is immediately absolued or perfected as the Touch is. That which we Taste we immediately touch with our Tongues, neither is there Sensation made till the object light vpon the Organ. If any man shall imagine that there must be a *Medium*, I aske the question what he will assigne. One of the foure Elements or some body compounded of them? Surely neither these nor that. For if it be an Element it must be Fire, or Aire, or Water, or Earth. But not Fire, for that is hot and dry, which would not conserue but consume the moisture wherein especially the object of taste is seated. Now the office of a *medium* is to conserue the Object not to destroy it.

No Element
can be the
Medium.
Not Fire.

Adde hereto, that the efficient cause of Savors is heate, but one and the same cannot be the efficient cause and *Medium* of the same thing. Againe, if Fire were the *Medium* we might like a Salamander liue in the Fire, or champe burning coales and not be hurt.

Not Ayre.

The Aire is not fit for this function, for the Sapor resideth in the mixt body out of which it neuer yssueth, wherefore the *Medium* that must leade the Sapor vnto the Organ must also transport vnto the organ the mixt body wherein the Sapor is, but the Aire being a simple and liquid Element is not fit to carry a solid matter.

Not Water.

The Water cannot be the *Medium*, because we do not liue in it, and therefore it is not contiguous with the Object and the Organ.

Not Earth.

Much lesse the Earth, for that is cold and dry, both which qualities are contrary vnto Savors, and therefore will rather vtterly destroy them then conserue and maintaine them.

There are no
pure Elements

One word might haue serued all, There are no pure or simple Elements, and that which is nor cannot be a *Medium*.

No compound
body.

Is it any compounded body? No, for a compound body would disturbe and hinder the Taste. Beside, every mixt body if it haue neuer so little humidity in it, is of it selfe gustable, that is, the object not the medium of Taste. We conclude therefore that taste is made without any outward medium. Yet we doe not say that Taste is made without any intermediate Body adioyning to the organ of Taste. For as in touching we haue already said in the second Book that the scarf skin was made by nature to come between the object and the skin it selfe which was the organ, not to be a medium (for that office it doth not performe) but a little to dull the quality of the object; so likewise in Taste which we haue often said is a kinde of Touching, we hold that the membrane which inuesteth the tongue doth performe the same office to the organ, which therefore we may say is as it were a medium; though indeed and in truth it be not so.

What kind of
medium is ne-
cessary.

QUEST. LXII.
Of the Organ of Tasting.



Having thus said what wee could for this present concerning the medium of Tasting, we now come vnto the organ. Concerning which there is no doubt made, all men herein beleeuing their sense that the tongue is it which discerneth the differences of Savors. For not onely reasonable but all vnreasonable creatures, when they would taste any thing, doe lay it to their tongues:

tongues: or if they cannot doe so, they lay their tongues vnto it to distinguish the tast thereof. Some haue thought that the pallat is the instrument of this sense, which we find false, because those men whose pallats are eaten out with the French disease, doe yet taste their meate well enough. It must therefore be the tongue; though I am not ignorant that some haue attributed this faculty to the teeth, whose arguments haply we may answer in another place, if at least we shall not thinke them vnworthy our resolution.

That the Palate is not the Organ of Tasting. Nor the teeth.

But there are some who haue conceiued with better reason that the membrane which inuesteth the tongue is the true organ of Tasting: Among whom is *Valesius* in the foure and twentieth Chapter of the second booke of his controuersies. But hee affirms it onely, confirms it not, yet because so worthy a schollar hath affirmed it, wee will endeavour to make the contrary appeare.

Nor the membrane of the Tongue. *Valesius* refused.

First therefore the temperament which is common to it with other membranes doth deny it this priuiledge, for it is cold and dry, both which qualities are contrary vnto Savors. Now the qualities of the organ must not be at daggers drawing with the qualities of the obiekt, but rather friends, and liue neighbourly together, so as the organ may be potentially that which the obiekt is in deed and act.

The first Argument.

Againe, the same membrane which incompasseth the tongue, doth also inuest the nostrills, the pallat and the gullet. If therefore the membrane were the organ, this sense should be made in all these parts, which we find by experience not to be so. *Valesius* very vnadvisedly resolueth that this very membrane incompassing the nostrills is the organ of smelling, & saith, that it is the diuersity of the temperament which maketh it in the tongue the organ of the tasting, and in the nose the organ of smelling. But he is fowlyly deceived. For suppose it had in these places a different temperature, we must not thinke that only the temper is sufficient to distinguish the organs of senses: but beside to diuers actions there is required a diuers substance; diuerse I say, and such as is not elsewhere to be found: Now this membrane although the temper doe somewhat differ in seuerall places, yet in qualities and substance it is like it selfe appearing so, both to the sight and to the touch.

The second Argument.

Finally that is the principall part of the instrument into which a soft nerue doth determine, but into this coate no man will say the nerue doth determine who hath but touched Anatomy with his vpper lip; yet *Galen* in the second Chap. of his 16, booke *de usu partium* seemeth to affirme the same in these words. *As the hard nerues are inserted into the muscles, so are the soft into their proper Organ, as into the membrane of the tongue.* So that hence it might seeme to follow that this membrane is the proper instrument of Tasting. But this place of *Galen* is no whit against our opinion. For we thinke & confesse that that into which the nerue determines is the true organ. But *Galen* doth not say the nerue determines in the membrane, or coate of the tongue: he saith it is inserted into it, whence we may rather gather, yea therefrom it is conuincied that the substance of the tongue is the organ we treat of, because into it the nerues do determine: for being inserted into the membrane the extremity thereof reacheth vnto the substance of the tongue to defer and confer the faculty thereunto.

The third Argument.

Obiection out of *Galen*.

Galen expounded.

Obiection, Answer.

But it will be obiekted, that if this coate or membrane be ill affected the Taste is therewithall depraued. We yeeld it to be true: yet not because the Taste is perfected in that part, but because this membrane concurrerh to the action of Sensation, without which in deed we cannot Taste; so in the eye, if the Horny membrane be violated the sight is then depaured: and yet it doth not follow that the Horny membrane is the chiefe Organ of sight. And thus we must vnderstand *Galen* in the second Chapter of his 4. Booke *de locis affectis* where he saith that the Taste is vitiated if the membrane of the Tongue be distempered. Or we may say that this membrane is as it were the *Taster* to the *Taste*, which office it hath partly from his owne proper temperament, partly from the soft nerues which are inserted therein, vnlesse you will say that these nerues were allowed to the membrane by Nature to giue it an exquisite sense of Touching, whereof the Tongue stood in neede for the defence of his substance, which assertion will not be against reason.

Galen expounded.

We conclude therefore that the membrane of the Tongue hath an exact Sense of Touching, nor altogether deuoide of Tasting, not that it tasteth at all of it selfe, but being contiguous, yea continuall and growing to the substance of the Tongue, it concurrerh withall to the perfection of the action, so as without it the Sense of Tasting cannot be perfected nor accomplished.

The conclusion.

Notwithstanding, we finde another principall part to which, as this membrane, so all the other adiacent parts are substituted by Nature as helpers and handmaides, and that is

That the body
of the tongue
is the true Or-
gan.
Arguments.

the proper and spongy flesh or pulpe of the Tongue. For beside that it hath a substance such as you can nowhere finde the like in the whole body, the Temperament also thereof is apt to enertaine and receiue Sapours; for it is moyst and hot, neare of kinne vnto the Nature of a Savour, that it might more easily be altered thereby. And indeed for the making of this Sensation, it is necessary that the Organ should put on the nature of the object which *Aristotle* meaneth, when he saith that the Organ must potentially be the same thing which the object is actually, that so it might be altered and actually receiue the nature of the object; for how shall it iudge of the object vnlesse it doe put on the qualities thereof.

Adde hereto that it hath an ingenite humidity, that those objects which are potentially moyst, as Salt is, being by this organ actually made moyst might become sapide, that is, freely and frankly exhibite their Sapours.

Againe, what greater argument can there be, that this flesh should be the organ of Tasting then because it is spongy, for Taste is neuer made vnlesse the moysture that carrieth the Saviour be imbibed by the organ of Tasting, to which purpose nothing is so fit as the spongy pulpe of the Tongue. Moreover, al the other Senses are double, and therefore Nature, though she had great reason to make the Tongue single for the commodity of the voyce, and such other circumstances as we haue particularized in our History: yet that it might be after a sort double, she hath drawne a line through the middest whereby it is diuided into a right side and a left. On the manner there is no part in the mouth deuided, but in the mouth is the Sense of Taste, and therefore it must belong onely to the Tongue.

QUEST. LXIII.

Whether the Tongue alone doe Taste.

That it may be
communicated
to others.

WE haue proued that the Flesh or Pulp of the tongue is the true instrument of Tasting. Notwithstanding it is doubted whether this Action belong only to this part or may also be communicated vnto others. That it may be communicated to other parts; some arguments are vrged. First, the Taste is a kinde of Touching, but Touching is diffused through all the body. It may seeme therefore that the Taste is also diffused through more parts then one, especially so farre as the meate doth attaine, that is, into the Mouth, the Gullet and Stomacke.

Againe, there yssueth out of the Braine a soft nerue which is simple & single in his originall, but when it hath paced a little forward, from the skull it is deuided into two branches: whereof one is inserted into the Tongue, the other into the lower parts.

Thirdly, we see that the Stomacke doth reiect and cast vp some meates by vomit, others it embraceth and containeth.

In like manner the Gullet swallowes some meates well and freely, others not without loathing and much difficulty, yea some meates because of the enmity betwixt the Stomack and their Taste, euen after they are downe are cast vp againe.

It may therefore be demanded how this choyce can be made, this loathing or liking stirred vp, vnlesse we say that the Stomacke and the Gullet do Taste and distinguish the differences of Sapours.

Adde hereto the authority of *Aristotle*, who in the 11 chapter of his fourth Booke *De partibus animalium* saith, that Fishes in their swallowing do take pleasure and haue a sense of the meate that passeth into the Mawes. Without doubt these arguments are not to be contemned, and yet we will make answer vnto them.

Answer of the
first.

To the first we say, that though the Taste be a kinde of Touch, yet it is not necessary that it should in all conditions answer or be proportionable to the Touch.

To the second.

To the second, that although the Nerue which is inserted into the tongue do transmit another branch to the Gullet and the Stomacke, yet it doth not follow that the gullet and the Stomacke must taste, for the soft nerues do transport the faculty of sensation; yet that the Eye sees colours, the Eare heares sounds, the Nose perceiues odours or sanours, is not by reason of the Nerue, but because of the disposition and temperament of the organs. For the faculty of sensation is euery where one and the same, neither is there any difference in the faculty whereby we heare, from the faculty whereby we smell, or from the faculty whereby we taste: but all the difference ariseth from the disposition of the organ. The Foote would see, and the Elbow would heare, and the sides would smell, and the crowne would taste, if in these parts there were a disposition to receiue the objects of these Senses.

The differences
of the senses
depend
on the diversities
of the Organs.

In like manner, although the Gullet and the Stomack do receiue a soft Nerue, yet the Gullet and the Stomacke do not Taste because they are not disposed thereto. But the Reason why Nature hath giuen them this soft Nerue we may finde in *Galen* 2 chap. of his 16 booke *de vſu partium*, to wit, because they stood in neede of an exactnesse of sensation. Now (saith *Galen*) those parts which had need of exact Sense, haue all of them receiued soft Nerues.

From this that hath been said, we may shape answers vnto the rest of the arguments. That the Gullet swallowes some meats, and loaths others; that the Stomacke retaines some meats and casts vp others, we ascribe vnto the pleasure or paine which they feele from the tactile qualities: for of the parts of the body of man none hath the Sense of touching so exquisite as the Stomacke. For beside that it is membranous it hath an infinite number of branches of Nerues inserted therein, that it is no wonder if it kicke against the least offence. So if wee thrust our fingers into our throats we can procure a Vomit, not that we make our Stomacke loath any thing, but because the Tactile qualities doe vrge and prouoke a sensible part. We also may say, that because of the contiguity of parts the Stomacke is fore-warned by the Tongue, so that the Tongue perceiuing any horrid or vnpleasant sauour communicateth the Sensation to the stomacke, forwarning it of an approaching enemy, which thereupon stirring vp it selfe as it were to battell, yerkeeth against it and casteth it forth. And to say true, there is such an instinct in Nature bred and seled in those parts. For we may not attribute the sense of Tasting to the Gullet or Stomacke, because if these parts had Taste, the sicke man that takes a pill or Boile wrapt vp in Sugar would neuer retaine it, which if he take without Sugar hee presently casts vp againe: and the reason is, because when they are not rowled in Sugar or otherwise made sweet, their bitter or vnpleasant Sapour is perceiued by the Tongue, and warning thereof giuen to the Stomacke. They are retained being sweetned because that till Taste is obscured and so the Tongue deceived. Being now arriued into the Gullet or the Stomack although the Sugar melt from them yet they are not cast vp againe, because the stomack doth not perceiue their Sapour. And this is the reason why when we would let downe any vnſauoury thing into the stomacke we endeouour not to touch the Tongue more then of necessity, least it should be prouoked thereby. We conclude therefore, that neither the Gullet nor the Stomacke do perceiue Tasts or Sapers but onely the Tongue.

To the third.

Why the Stomacke casts vp some meat and retaines other. Another answer to the Argument. Of the swallowing of Pills.

QUEST. LXIII.

In what part of the Tongue the Taste is most exact.

Having found out the Organ of Tasting, it remaineth in the last place to search in what part of the Tongue the sense is most exact, for there is no question but there is a great difference.

There are some reasons to perswade vs that the backpart of the tongue doth taste better then the forepart. First, because at the back-part of the Tongue the Almonds are seated on either side which doe receiue the spittle and a great quantity of moyſture: wherefore because the spittle doth helpe this sense very much, it is to be imagined that where there is most spittle there is best Tasting. Again, the Nerues which are inserted into the backside of the Tongue are greater then those which are inserted into the foreside. Yet *Aristotle* holdeth the contrary and proues his assertion to be better, for what can be more certaine then experience.

That the back part tasteth best.

If therefore we desire to Taste any thing more curiously we apply it to the tip of our tongues, and if it fall toward the roote we call it backe againe. Again, when we are to swallow any thing whose taste is displeasing to vs, we hasten it to the roots of our tongue as soone as we can. The reason is, because the sense of Tasting is not there so exquisite. Moreover, it is very reasonable that the Taste should be more perfect in the fore-part, because this sense was allowed to the creature to discern hurtfull Tasts and to auoid them. But if the perfection of the Taste had beene at the roots, that which is offensive might haue slipped downe before we were aware, whereas the tip of the Tongue discerning the difference best, is also best able to free it selfe from that wherewith it is offended. Adde hereto, that the forepart of the Tongue is softer, more spongy and better disposed to imbibe the humidity wherein the Sapour is contained.

The contrary opinion. Aristotle. Reasons.

We conclude therefore, that the perfection of the Taste is not in the roots but in the tip of the Tongue.

The

Answer to
the former
Arguments.

The arguments that were brought to prooue the contrary may be answered. For because there is so great a plenty of moisture at the roots of the Tongue, therefore the best Taste should not be there; for superfluous humidity doth not quicken the Taste but dulles it.

Neither do we deny but that the Nerue is larger at the roote of the Tongue, but it doth not follow that therefore the Taste is there more perfect, because in the fore-part though the Nerues be lesse, yet they be more plentifull and abundant, and there do cause the Taste to be more perfect.

And thus we are come vnto an end of these Labyrinths concerning the Senses, wherein we haue beene somewhat the more prolix, that those which loue the contemplative part of Philosophy might haue something wherewith to please their appetites. It is true indeede that there are many passages in these Controuersies, which for the most part we haue taken our of *Iulius Casserius Placentinus*, which might well haue befitted the Schooles themselves,

but we imagine that these our Labours may haply fall into some mens hands who will be willing to recognize those Studies which for better employments they haue intermitted. A very few of which kinde if I shall giue contentment vnto, I

will not thinke my labour ill bestowed. Other men who do not vnderstand them, or else are better able then my selfe to satisfie

themselves, may turne ouer to that which shall be more

fittig for their Dispositions. And so we will

leauē the Head and Senses, and come

vnto the Ioynts.

The end of the Eight Booke of the Senses, and the
Controuersies thereunto belonging:

THE

which the other
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Galen hatla tak
Bookes de v'su p
We shall thinke
Volumes in th
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Rea



THE NINTH BOOKE.
Wherein the Ioyntes are briefly
Described.

The Præface.



IN the whole body of Man there is nothing more wonderful then the structure and position of the Ioynts, nor any thing wherein a man doth so much differ from all other creatures. The bowels are most what a like in all, both for Nutrition, Generation, Life and Sense, because all creatures have like vse of all those parts as well reasonable as vnreasonable. The only thing which makes the difference is the Reasonable Soule which is inuisible, a Nature transcendent and aboue the Nature of the body. Next to that, the fashion and position of the Ioynts whereby the body is lifted vp from the earth (vpon which the other creatures doe grouel) maketh the greatest difference between man and beast. It were a world of wonder to enter into discourse of the particular Reasons of this position, and we haue partly handled them before in the first Booke, but especially we purpose to prosecute them in this ninth Booke destined to that purpose.

Galen hath taken especiall paines in this argument appropriating thereunto his three first Bookes *de vsu partium*, wherein he hath preuented any man that should take paines after him.

We shall thinke we haue quit our selues well if we can in some sort abbreviate those large Volumes in this place, wherein we haue laboured so much the more to be as concise

as the subiect matter will giue vs leaue, because all the particulars will fall vnder our discourse in our bookes of the Muscles the Vessels and the Bones. The

Reader therefore is to be intreated to content himselfe with this

bare ouerture, wherein we will but muster the parts close

together, because we shall haue time and scope to

draw out our troopes and to marshiall them

in better order, when we come into

the large fields of the Bookes

which follow.

CHAP.

CHAP. I.

A brieft description of the Ioynts.



E before deuided the body of Man into three Regions or Venters, and the outward parts or the Ioynts. Through the three Regions, Naturall, Vitall and Animall, we haue carried our Story with as great breuity and perspicuity as wee could, it followeth now that we prosecute our History vnto the Limmes. The Ioynts therefore which grow vnto the body as boughs vnto the trunk of the tree are called in Greeke *κῶνα* and *γῆνα*, in Latine *artus ab artando*, in English we will call them Limmes or Ioynts, because there are most ioynts in them.

Two kinds
of ioynts.

The diuision
of the hand.

There are therefore two kinds of Ioynts, the vpper and the lower; the vpper ioynts are called by the common name of the *Hand*, for the Ancients accounted the whole member from the shoulder to the fingers ends to be all the *Hand*. The lower Ioynts are likewise called *Pedes*, that is, the *Feete*, of which we shall speake afterward. The whole *Hand* *Hippocrates* and *Galen* doe deuide into three parts in *Brachium*, *Cubitus*, and *summam* or *extremam manum*, that is, the *Arme*, the *Cubit* and the *Hand* as we vse to call it.

The arme.

The *Arme* *Celsus* calleth *humerus*, *Festus* calleth it *Armus*, whence our word came. The Head which is inserted into the broad bone or blade of the shoulder is called by *Pollux* *ἐκφυλῖς*, by *Euripides* *ἐπαυρίς*, the end is called *ἀκρωτήριον*.

The cavity vnder the ioynt of the shoulder *Aristotle* called *axilla*, commonly *ala*, because in it do grow hayres as feathers in a wing which is called *ala*, and we call it the *arme-hole*.

The Cubite?

The second or middle part is called in Greeke *πῦξ* or *ἀγκύον*, in Latine *Cubitus* or *Vlna*, we will call it the *Cubite* to distinguish it from the vpper part which we call the *Arme*.

The hand.

The third part is called *Manus*, from *manare* to flow, because it floweth as it were out of the *Cubit*; this we call properly the *Hand*, and it hath three parts, the wrest called *brachiale*, the After-wrest called *post-brachiale*, and the fingers called *digiti*, of which we shall speake in their due place. And this is the common diuision of this ioynt. Wee now will follow the particular parts of the diuision.

CHAP. II.

Of the parts of this Ioynt in generall.

The veines of
the whole
hand.



He proper parts of the whole *Hand* taking it in the large acception of the Ancients, are beside the common parts which we pretermit, the *Vessels*, the *Muscles* and the *Bones*. By the *Vessels* I vnderstand the *Veines*, the *Arteries* and the *Nerues*. The *Veines* which are deriued through this whole member doe arise all from the *Axillary* branch: and there are two, the first passeth along on the inside, the other on the outside of the *arme*. That on the inside is called *Basilica*, that on the outside is called *Cephalica*. The *Basilica* *Hippocrates* calleth *Venam internam* the inward veine. Others call it *Hepatica* and *Iecoraria*, that is the *Liuver-veine*. And it is ordinarily deuided into a deeper and a shallower. The deeper climbing ouer the axillary Artery and the third paire of sinewes passeth along to the bough of the *Arme* which we commonly call the *Elbow*; and so bestoweth his branches vpon both the bones of the *Cubite*.

Basilica.
The Liuer-
veine.

The shallower runneth vnder the skin to the ioyning of the *Cubite* with the *Arme* where it is clouen into two boughes, one of which passeth to the inside of the *Cubite*, and there is vnited with a branch of the humerary veine, and from that coniunction ariseth the *Common veine* which they commonly call *Mediana* or the middle veine; the *Arabians* call it the *black veine*. The other bough descendeth along the lower side of the *Cubite* sprinkling the skin and parts by which it passeth with diuers small branches.

Mediana.

The blacke-
veine.

Cephalica or
the head veine.

The *Cephalica* or *Head-veine* so called, because it is opened in diseases of the *Head*; *Hippocrates* calleth *externa* or the outward veine, because it creepeth along the outside of the *arme*: others call it *Humeraria*, (because it passeth through the shoulder betwixt the Muscle called *Deltoides* and the Tendon or chord of the *Pectorall* muscle) which falling down vnder the surface of the skinn, when it commeth vnto the bough of the *Cubite* is deuided into two branches; the one borne along obliquely into the inside of the *Cubite* coupleth it selfe with the branch of the *Liuver-veine*, and betwixt them beget the common or middle *Veyne*; the other which is larger descendeth by the *Radius* almost to the middest there of.

of and hence running obliquely to the wrist, it watereth almost all the backe of the hand, and endeth in a notable and manifest branch, betwixt the little and the ring finger: where it is called *saluatella*, and is opened, as authors say, with good successe in spleneticke persons.

Saluatella.

The Arteries of the hand.

The arteries which belong to this hand doe proceede in one bough from the axillary artery, and this bough is called *Basilica*. It hath two branches, one ferled deeply. the other eminent between the skin and the flesh. Both of them do afford many deriuations out of themselves, but that of the shallower is most notable which is oftentimes to be seene in the inside of the wrist a little about the roote of the thumbe, at which place and by which artery we vse to feele the pulse to find out the differences thereof.

The pulse.

And for sinewes there are six paire disseminated through the whole hand, the first commeth out of the first racke bone of the necke and is spent in the Deltoides muscle and the skin neere vnto it. The second arising from the first racke bone of the necke first passeth into the double headed muscle; then it casteth off a small branch to the long muscle of the Cubite, and at length when it attaineth to the elbow it is diuided into branches. The third being mingled with the second, reacheth his helpe to the muscle of the arme, which lyeth vnder that with a double head. The fourth which is the largest of all the rest falling vnto the same muscle together with the deepe liuer-veine and the inward artery is deuised into diuers branches. The first passeth along betwixt the muscles, which bend and extend the cubit, and hauing gotten ouer behind the inward proceffe of the arme, and being mixed with the third coniugation, is consumed in the fingers, giuing to the little finger two nerues, to the ring finger likewise two and to the middle finger one. The sixth paire sliding downe between the skin and the neruous membrane by the inward proceffe of the arme determineth into the skin of the Cubite. And these are the vessels of the whole hand whose description we shal more exactly set downe in a fitter place hereafter. The muscles of the whole hand are very many, some moue the Arme, some the Cubit, some the Radius, some the wrist and some the fingers, of which also we shal speake in their proper place. The bones of the hand are diuers, the arme hath one bone, the cubit two, the wrist eight, the afterwrist foure, the fingers fifteen, to which we may adde if we please the small seede bones called *Sesamoidea*, all which we wil as curiously and accurately as we are able describe in our booke of the bones, whither at this time we refer the reader.

Six paire of sinewes of the hand.

The first.
The second.

The third.

The fourth.

The fifth.

The sixth.

The muscles of the Hand.
The bones of the Hand.

CHAP. III.

Of the excellency of the hands.



Man, who is the crowne and pride of Nature, that bold and confident worke-Mistrisse, him I say, God on his birth day, did cast out vpon the dust of the earth, naked, vnarmed, and weltring in his blood, to enioy or rather to deplore an inheritance of sorrow and misery. Yet notwithstanding because he is sent into the world to be a combatant and not a sluggard, he hath armed him with two wondrous weapons, which he hath denied to all other living creatures, Reason and the Hand. His reason is the storehouse of all arts and sciences, the first ground-worke and foundation of whatsoeuer the immortall soule is naturally capeable or apprehensue of; an Art it is, as before all Arts, so hath it all Arts for his subiect or matter whereabout it is occupied. The hand is an instrument, but as it is the first instrument so it is the framer, yea and imployer of all other instruments. For not being framed for any one particular vse it was capeable of all: so as it may iustly be compared to the soule, which as the Philosopher saith is, though not in deed yet in power and ability all things. By the help of the hand Lawes are written, Temples built for the seruice of our maker, ships, houses, instruments, and all kind of weapons are formed. I list not to stand vpon the nice skill of painting, drawing, caruing, and such like right noble Arts, whereby many of the Ancients haue made their names honorable vnto vs, yea and eternized them to the worlds end. By our hands we promise, we call, we dismisse, we threaten, we intreate, we abhorre, wee feare, yea and by our hands we can aske a question. By the helpe of the hand although a man be borne vnarmed, yet is he able to safeguard himselfe from all other creatures: and all those creatures which come strong and armed at point into the world, how fierce soeuer they be, how able to abide the violence of heauen it self, yet are they not safe from the hands of men. For doth not the industry of mens hands preuaile against the hornes of the Bull, the teeth of the Lyon, and the paw of the Beare? yea whatsoeuer is comprehended vnder the cope of heauen, by the skill of the hand is brought vnder our subiection and made tributary vnto vs.

Man is the glory of Nature, whose workes shew his manship.

The weapons which man hath more then other creatures. What a man can doe with his hand.

And

Anaxagoras.

And therefore *Anaxagoras* as *Plutarch* reporteth, marking diligently the curious fabrick of the hands, the postures of the fingers, as they moue either together or apart, the mighty strength, the cleane nimblenesse and the soft delicacy thereof, ascribed vnto them the cause and originall of mans wisdom. How much wiser was *Galen*, who in those melodious Hymnes which he wrote to the praise of his Creator, I meane his Bookes of the Vse of Parts, discoursing very curiously concerning this curious instrument concludeth. That man is not therefore the wisest of all creatures because he hath Hands, but because he is the wisest of all creatures, therefore Nature furnished him with this excellent instrument. It was not the Hand that taught men Arts but Reason, yet the seruant and minister of this reason and wisdom is the Hand: they are the Vicars or Substitutes and Suffraganes of the speech, the interpreters of the secret Language of our silent conceits, signifying to all men in a few Letters as it were by Hieroglyphicks what the very thoughts of our Hearts are.

Galen.

The Hands
consecrated
to Faith.

Numa Pompilius consecrated the Hands to Faith, and therefore all Compacts, Couenants, Truces and enter-courses whatsoever are held inuolably ratified by the very touch of the Hand, and at this day in our neighbour-countries the Principall Nobility do sweare their allegiance into the Hands of their Prince or his Substitute.

The Hands
Emblems of
Fortitude.The vanity of
Chyroman-
tickes.

That very Touch was also among the *Persians*, the most sacred pledge of fidelity: and therefore the most Ancient did vse to salute one another on this manner, giuing and receiuing honor by this part. Likewise they which adore Princes or great Potentates are accustomed to kisse their Hand and incline their head. In the Egyptian Hieroglyphicks the Hand was the Embleme of Fortitude, and therefore they which seeke for helpe do call for the right hand, for so it is in our common Prouerbe, *Lend me your helping Hand*. I list not to commend the Hand from that superstitious Art or Imposture rather of such as call themselves *Chyroman-tickes*, whose idle speculations are not fit to be mingled with our serious discourse, which we will now transerre from the excellency and commendation of so curious an Instrument to a more Anatomicall consideration of the Vse, Figure and Structure of the same.

CHAP. III.

Of the Vse, Figure and Structure of the Hand properly so called.

The generall
vses of the
Hand.

HE true office of the Hand is to apprehend or to hold, and his proper action is apprehension (for *Hand* and *Holde* are Coniugates as we terme them in Schooles) from whence it is called *Organum* ἀρσενικόν, The First vse therefore of the Hand is to take hold. Another vse of it is to be the iudge and discerner of the Touch. For albeit this touching vertue or tactile quality be diffused through the whole body both within and without, as being the foundation of the Animall Being, which may be called *Animality*, yet we doe more curiously and exquisitely feeble and discern both the first and second qualities which strike the Sense in the Hand then in other parts. It is also an Instrument wel fitted to ease our paynes, to propulse or driue backe iniuries and to defend the fore-parts of the body. Wherefore for these vses and for the performance of all his functions it hath that figure which we see, and that admirable structure which as well as we can, we shall vnfold vnto you.

The hand the
Instrument of
Touching.The figure of
the Hand.

Why diuided.

The Figure is long and diuided into many parts that it might comprehend in one all kinde of Figures, the round or Spherick, the right and the hollow, for all figures are made of three lines, a crooked, an hollow, and a straight. Beside, this figure doth equally apprehend both greater bodies and lesse; for small things it holdeth with the ends of two fingers, the great finger or the thumbe and the fore-finger, If the body be a little bigger, it containeth it with the same fingers but not with the ends. If it be yet bigger, we vse three fingers, the thumbe, the fore and the middle fingers. If it be larger then we can containe with three, we vse foure, and so fise, and at length the whole hand. Now if the Hand had been made of one continuall peece, it would onely haue apprehended a body of one magnitude. Neither was it sufficient that the Hand should be diuided into fingers, valesse the same fingers had been placed in a diuers order and not in the same right line, so as one was to be set or opposed to the other foure, which being bowed with a small flection might meete and agree with the action of the other foure opposite vnto it. And this is the manner and proportion of the figure.

The structure
of the Hand.

For the structure if it be diligently attended, it will imprint in vs an admiration of the wonderfull

wonderfull skill and workman ship of Nature, and it is on this maner. Because the Hand was the most noble and perfect organ or instrument of the body: God the Creator moulded it vp of diuers particles, all which for our better vnderstanding we wil referre vnto 4. kinds.

The first kind is of those which originally and *by themselves* do performe an action; the 2. of those without which an action is not performed: the 3. of such as do more perfectly accomplish an action, and the last of such particles as do preferue an action.

The 1. and principall part of the hand is a muscle, because there is no apprehension without motion; now we know that a muscle is the immediate organ of voluntary motion,

The principall part of the hand is the muscle.

The 2. part without which there is no apprehension is a nerue; for the muscle moueth not vnlesse it be commanded, this commandement the nerue bringeth together with a subtile spirit, and therefore it is called *Lator* or the poast.

The 3. which accomplish the action are the Bones and the Nayles: the Bones do make the action strong and stable, without which the Fingers might indeed be extended & bent againe, but because of their softnesse they would euer haue beene trembling, and not able to haue holden any thing straight or firmly.

The bones and nailes do make the action perfect.

The Nayles further apprehension. The particles which do preferue the action are the veins, Arteries, the Skinne and the Fat. The Veines water it with blood; the Arteries quicken it with vitall spirit; the Skin and the Fat make a *Colligation* or tying together of all the rest.

CHAP. V.

Wherein is declared the reason of the framing of all the Similar parts whereof the Hand is compounded.

THe Muscle therefore is the principall part of the Hand by which immediatly apprehension is made. But because there are two especiall parts of a muscle, the Flesh and the Tendon or Chord, Nature placed many tendons and litle flesh vpon the fingers, because the end of the hand should be light and thin, not heavy and thicke.

Why the fingers haue litle flesh.

These tendons from their originall euen to their insertion are round; that they might be lesse subiect to outward affects, but in the very insertion they grow broader that the motion may bee more nimble. But because there are many motions of the fingers, to wit, right, as simple; flexion or extention; and oblique when they are brought together or parted asunder; it was necessary that there should be tendons both without and within and on the sides of the fingers. But how many muscles there be of the Hand, whence euery one of them ariseth and where they are inserted together, with their structure, we shall declare in the next Booke wherein we handle of sette purpose the History of all the muscles.

The tendons of the fingers.

Nerues they haue disperfed into their muscles and flesh, and those very many from the 4. and 5. paire of the Arme which yeeld vnto them the faculties of Sense and Motion. The Bones of the Hand are 8. of the Wrest, 4. of the After-wrest which are tyed together with a strict and immouable articulation or iuncture. The Bones of the Fingers are ioyned by *Diarthrosis*, for it behooued that they should so moue as they might be able to apprehend or take hold of all figures or fashions of things. These Bones are only 3. neither more nor lesse, for more would haue hindered perfect extention, and fewer would not haue admitted so many and diuers particular figures. And all these that the motion might be more facile and easy, are knit together by *Ginglymos*. Now the variety of the motions is furthered both by the gristle which compasseth their extremities, and by the fat and oyle humor which like a slime doth line the ioynts. But because when the creature according to his pleasure shall bend and bow these ioynts, they should not be disseuered or fall out of their seates, Nature hath knitte them together with iyes and bands, and wedged them in also with small bones like *Sesamum* seeds. For these small bones which are in the inner ioynts of the Hand, do not suffer the ioynts to *Luxe* or shoote inward when wee stretch out our hands strongly; and those that are placed in the outward ioynts keepe them from leaping outward when wee bend our Hands with violence.

Their nerues.

Their bones.

The iyes or bands.

The seed bones and their vse.

The further discourse of the Bones of the Hand you shall finde hereafter in the last Booke which is of the Bones: for to transcribe euery particular here, were to abuse my owne time and your patience.

The bones therefore do make the action more perfect. For if the fingers were without them, we should be able to performe those actions only wherein it behoued vs to draw the fingers

The vse of the
Nayles.

into a circular forme. The nayles also were made to further the vse of the hand; for hard and small bodies would easily fly from the fingers, vnlesse there had beene set to their ends a hard body, both to strengthen and establishe the flesh, as also to keepe in and retaine such small and slippery thing. Finally the veines,,arteries,skin,and fat, do preserue or conserue the action.

CHAP. VI.

More distinctly of the dissimilar parts of the Hand, of the Wrist
and of the After-wrist.

The wrist.



He Hand properly so called, hath three dissimilar parts: the Wrist, the After-wrist and the Fingers. The Wrist called *Carpus*, the Latins more vsually call *Brachiale*, the Arabians *Rafeta* or *Roseta*, because it was a custome to adorn that part with Roses, & diuers flowers. It consisteth of eight bones set in two ranks, which haue no proper

The afterwrist

names belonging vnto them. The After-wrist called by the Latins *post-brachiale* and by *Celsus* *Palma*, is deuided into two parts, the internall and the externall: the internall part which makes the hand hollow when it is stretched forth, hath his name in *Hippocrates* from a word which signifieth a stroke, because with the palme we vse to strike. The Latins call it properly *Palma*,

The palme.

and so doe we the Palme of the hand: which when it is crooked and hollowed is called *vola manus*. The outward part which is the backe of the hand is called *manus auersa* or *dorsum ma-*

The backe of
the hand.

mus. In the Palme of the hand there are many particles obserued. For the beginning of it which riseth a little toward the inside of the wrist is called *Radix manus* the roote of the hand. The

The hillocks
of the hand.

middle part is called *Interstitium* or the partition. The fleshy swellings which the Chyromanticks call hillocks or monticles doe make the brawne or pulpe of the hand and are called properly *Siyapa* of a word which signifieth to smite. That hillocke which is vnder the thumbe is called *mons martis*, that vnder the fourth finger, *mons Iouis*, that vnder the middle finger, *Saturni*, that vnder the ring finger *Solis*, that vnder the little finger is dedicated to *Venus*. The

The lines.

Thenar that is the space which is betwixt the thumbe and the fore finger is called the hill of *Mercury*: and the *Hypothenar* which is the brawne betweene the roote of the thumbe and the little finger is called the *Moone hill*. Beside these, there are also in the *Vola* or cup of the

The line of life

hand many lines, by the sight and obseruation whereof, the Chyromanticks doe promise and take vpon them, to foretell the length or shortnesse of the life, good or euill fortune, Naturall inclinations, and in a word the euents of all accidents: with how great reason or from what cause or ground either in Nature or in diuinity, *ipsi viderint*: we wil only for distinction sake, and because it is rather lookt for at our hands then that we approue any such impostures, name them vnto you. They are said to be fourteene, but three are principall: the first which com-

The naturall
line.

passeth in the thumbe is called *Vitifera* the lyne of lif, by others *Temporalis*, or the line of tyme. The second which runs ouerthwart through the midst of the *Vola* or cup is stretched

The table line
or line of venus

to the moone hill, and is called *Iecoraria* the Liuer line or the naturall lyne. The third beginneth from the *Hypothenar* or moone hill, and reacheth to the mount of *Iupiter* and is called the table or bed lyne of *Venus*.

Why 2. hands.

When the hand is shut it is called *Pugnus*, or the fist; when it is halfe bent it is called *condylus*. Further we must obserue that Nature hath made two hands, one to helpe and assist the other, the right, and the left. Some there bee which can as well vse this as that, and are called *Ambidextri*. A woman saith *Hippocrates* cannot be an ambidexter, that is, she cannot vse both hands alike.

CHAP. VII.

Of the Fingers of the Hand.

The parts of
the fingers.



He last part of the hand containes the Fingers, called *digiti*, whose order and rank is called *Phalanx*; the internall articulations or ioynts are called *internodia*, the knots of the fingers. The fingers ends which are round and fleshy are called *Vnea* or the grapes. The outer part of the fingers haue knubby or knotty ioynts cald in

Why 5. fingers
and no more.

Latin *Nodi*, wee call them knuckles, and there are three in euery finger. Each hand hath five fingers.

fingers, neyther more nor lesse, that the apprehension might be more perfect. For take away the thumbe, and you take away the power and strength of all the rest: if you take away the little finger you cannot incompasse any thing circularly. Now these fingers were made vnequall in length and magnitude that we might the better comprehend all figures and all quantities both greater and lesse. The first, because in strength it is equipollent or equivalent to all the rest, is called *pollex* or the Thumb and hath only two ioints. And this finger hath peculiar muscles, bending, extending and leading it too and fro, because it hath something peculiar in his motions. The second is called *Index* from his vse, because we vse it when we would shew any thing. *Suetonius* calleth it *Salutaris*, it hath a Greek name also from a word which signifieth to licke, because with it we vse to taste or like any thing. The third is called *Medius* or *Famosus*, the middle from his situation, *Famosus* because by stretching this finger forth we vse to deride or disgrace when we list.

The Thumbe.

The for finger

The middle-finger.

The fourth is called *Medicus*, because therewith in old time they vsed to mingle or stir medicines; tis also called *Annularis* or the Ring finger, because the Rings are there most commonly woine. The fift, because it is the least is called *Minimus*, and *Auricularis* because with it we picke our eares. Every finger hath three bones ioyned by *Ginglymos*, as we shal say hereafter. Finally, for more steddy apprehension there are nailes set vnto the fingers ends engendred of the more crasse and thicke excrements of the third concoction, and therefore they grow continually only in length as do the haire. But their growth is not by nourishment but by an imperfect accruing of the matter, for there is no traction or assimilation of aliment, but only an apposition of excrement.

The Ring finger.

The little finger.

The nature of the Nailes.

They are moderately hard that they might not be hurt with outward things rushing against them and also round for their further security, the Latins call them *Vngues*, their roote which is like a white moon is called *Radix* or *Ortus*: the tops which we pare off, *Extremitas*, the white spotted in the naile *Mendacia*, so many spots so many lies. And this shall suffice for the description of the vpper ioynts, now follow the lower.

The parts of the Nailes.

CHAP. VIII.

Of the Foot in Generall, his Excellency, Figure, Structure and Vse.



Man alone, because he was the wisest creature had Hands giuen vnto him the first and originall instruments of the world, so hee alone of all creatures which dwell vpon the earth and vse feete onely, hath two feete answerable to his two Hands; for if hee stood groueling on foure stiltes, how could hee ride, write, build, throw a weapon, or exercise any of those Arts wherewith hee is furnished? The Figure and posture of brute beasts had beene altogether vnprofitable and incommodious for this Diuine Creature, for neyther could he haue looked vp to Heauen, for which cause euen *Anaxagoras* could say that hee was created; nor sit him down to meditate, for they say, that the sitting Soule is the wisest; neyther could he passe through sharpe vnequal or sloping places, climbe Turrets, build houses, or any such thing. It is true, that the more feete the swifter is the creature (other things being equall,) but what need had man of such footemanship to overtake, when by his industry he is able to circumuent all other creatures? Hee was therefore made *Bipes* that is, with two feet, and therefore he standeth vpriight or sitteth at his pleasure.

Why a man hath but two feete.

The proper vse of the foote is to walke and the action is walking, and therefore the foote is called *Instrumentum ambulatorium* or a walking Instrument. This walking is when one Legge resteth vpon the ground, and the other is brought about forward. The resting is the action of the foot properly so called: the reach forward the action of the leg: and therefore seeing ambulation is made by station and motion, that is, standing and proceeding, the foot it selfe is the instrument of the former, and the whole leg of the latter.

The Office of the Foote.

How ambulation is made.

Now for assured and constant or firme station, as also for the accomplishment of those many motions wherof we stand in need, the structure & figure of the foot and leg is such as we see. For it is diuided into diuers ioynts, and the toes are made long and broad not so long as in the hands, but only as was necessary to fasten the feet when we would strue to run. For if the toes be pressed vnto the ground, it is strange with how much strength and security the body is driven forward.

The figure of the Foote.

The likenesse
betwixt the
Feet and the
Hands.

Moreover, the feete were made hollow in the midst that they might better passe thorough all places: for the hollow soale encompasseth that which is round or gibbous whereon wee tread, and the Toes do hold vs fast in right, oblique, sloping and ascending progressions. There is a great similitude betwixt the feete and the hands, so as we haue seene some who had no hands to do all the offices of the hands with the feete.

CHAP. XI.

The similar parts of the Foot in the large acception.

The similar
parts of the
foote.
The veines of
the foote.

LI that by the Ancients is called the Foote which reacheth from the hip joint euen to the end of the toes: It may be diuided into similar and dissimilar parts. The similar parts as in the hand so here are contayning or contained; contayning, as the scarfe-skin, the true skin, the fat & the fleshy membrane. The parts contained are the vessels, the flesh and the bones. The vessels are of three sorts, veines, arteries, and sinews. The veines doe all deriue their pedegree from the Crurall branch. This crurall branch shooteth out of himselfe many sprays through the thigh, the leg and the feet, deuided into many twigs. Six of them are among the rest most conspicuous & are called by these names: *Saphena*, *Ischias minor*, *Muscula*, *Poplitea*, *Suralis*, and *Ischia maior*. The *Saphena* or ankle veine arising from the kernels in the groine passeth down on the inside of the thigh betwixt the skin and the fleshy membrane, and reacheth over to the outward ankle and is after diuersly consumed or spent into the skin of the top of the foot. The lesser *Ischias* opposite to the *Saphena* is distributed into the fore skinne of the hip and the muscles of that part. The *Muscula* is diuided into two branches the lesse of which watereth the muscles which extend or stretch forth the legs. The greater lies deep in the flesh, and is diuersified almost into all the muscles of the thigh.

Saphena.

The lesser
Ischias.
Muscula.

The Poplitea.

The *Poplitea* is made of two branches of the crurall veine ioyning together, and after it hath sent some small sciencies into the back skin of the thigh it falleth down through the middest of the leg, and is sometimes spent into the skin of the calfe, sometime it passeth to the very heele, and sometime turneth aside into the outward ankle.

The Sural.

The *Sural* veine is disseminated into the muscles of the *Sura* or calfe, and vnto the skinne which is on the inside of the leg: and being reflected about the inner ankle, it attaineth vnto the inside of the foot and the skinne of the great toe, very rarely to any of the other toes. The greater *Ischias* hath two parts, one greater which passing through the muscles of the calfe spendeth it selfe into ten shoots allowing two to each toe. The lesser which endeth betwixt the Perone and the heele sometimes perforating the ligament in the middest, is dispersed into the muscle which draweth the toe backward and into the skin. The crurall artery brancheth it selfe like the veine, so that euery veine hath an artery accompanying it. The nerves which are disseminated through the whole leg are foure and those very notable, which arise from the three lower paires of the loynes, and from the foure vpper of the holy or great bone. The first and the vppermost falling vnder the *Peritoneum* to the little Trochanter is consumed into the muscles of the thigh, and into the skin, both on the out and the inside, before it touch the knee. The second and the lower, descendeth through the leske together with the crurall veine and artery into the thigh, and sendeth a notable branch to accompany the ankle veine through the inside of the thigh, euen vnto the foot, in the meane time bestowing smal tendrills vnto the neighbor skin, but the greater part of it together with the veine and artery is dispersed into the inner muscles of the thigh. The third lower then the former disperseth his fauors to the muscles of the yard, and to some of the muscles also of the thigh, not forgetting the skin of the leske, and afterward it determineth in the neighbour muscles about the middle of the thigh. The fourth which is the thickest, driest and strongest of all the nerves hauing his originall from the fowre vpper spondels of the *Os sacrum* or the holy bone, gliding along betwixt it and the hanche bone, affordeth certaine branches vnto the neighbor parts, as vnto the skin of the buttocks and of the thighe, and to the muscles contained vnder them. Afterward departing into two branches, the lesser falleth by the *Perone* and giueth two shoots vnto each toe, the greater reaching along the leg and the foote, giueth likewise two branches to each toe, but both these boughs by the way as they passe doe touch at the heads of the muscles and at the skin of the leg, and the foote, and doe tye them together. And this shall serue for a short description of the vessels.

The arteries
of the foote.
The 4. nerves
of the whole
foote.

The

The muscles of the foot are diuers: some Bend the thigh, Extend it, Bring it to the Body, lead it from the Body and turne it about: others do moue the leg with the selfe same kinds of motions, others bend and extend the foot it selfe. Finally, there are others, which moue the toes of the feete, the particular history of all which you may require in the next Booke of the muscles. The bones of the feete are very many: one of the thigh, 2 of the leg, called *perone* and *tibia*, together with the whirle bone of the Knee: the wrest of the feete called *pedium* hath 7. bones: the after-wrest called *Metapedium* hath 5, and there be 14 of the Toes, to which may be added seed-bones like to those which we found in the hand. Of all which we will giue you satisfaction in our Book of the Bones.

The muscles of
the feete.
The bones of
the feete.

CHAP. X.

An expliation of the dissimilar parts of the whole Foot.



The great foot is diuided as the hand into three dissimilar parts, the *Femur* or thigh, the *Tibia* or leg, and the *Pes* or foot. The Thigh is called *Femur a ferendo*, because the creature is therewith sustained or held vp. The fleshy parts are cald by *Hippoc.* *αἰχμή*, the fore-parts *καρπία*. The Pulpy or fleshy part about the ioynt below is (on the backside into which the Knee is bent) called *Poples* the Ham, because it is folded *post*, that is, backward: the fore-part is called *Genu*, that is, the Knee. The second part of the foote from the Knee to the Heele is called *κνήμη* or *σκέλος*, in Latin *Tibia*, we call it the leg: the fore-part whereof *Antitibiale* the Shin, the hinder and fleshy part *Sura* the calfe: the two processe without flesh neere the bottome *Malleoli* or the Ancles. The last part of the foot is called *pes parvus* and properly the Foot, because it is the Basis or pedestal wherupon the whole body resteth & it is the true organ or Instrument of progression: and as the hand is diuided into 3 parts, the Wrist, the After-wrist and the Toes. The Wrist is called *pedium*, and consisteth of 7. bones, 4 of which haue proper names, the other 3 none. The forepart of this *pedium* is called the in-step. The backpart is round and is called *Calx* or the Heele, the lower part of it is called *Calcaneum*, because with it wee do *calcere Terram* tread vpon the Earth, and we call it the pitch of the Heele.

The parts of
the foot in the
large accepta-
tion.

The second part of the Foot consisteth of 5 bones and answereth to the After-wrist of the hand, in Latin it is called *Tarsus*, the lower part of it is called the plant or the sole of the foot, the vpper part betwixt the Instep and the Toes is called *pectus* or *dorsum pedis* the brest or back of the foot. Finally the toes are 5 answering to the fingers of the Hand, and haue their owne orders, making 3 ranks called *συντάξεις*, excepting the great toe. These bones are ioy-
ned by *Ginglymos*, and haue seed-bones for their firmer articulation: for these small bones make the Foote stronger when wee stand still or walke on; especially if our way bee through sharpe places, where otherwise the Toes might easily bee luxed if they could be turned backe with stones or any other higher or vnequall substance whereupon wee should tread.

The use of the
seed-bones in
the foote.

And this is the true and succinct description of the Ioynts, wherewith wee desire the Reader to rest contented at this time, because he shall finde a more accurate delineation of all the parts of them in their seuerall places in the Tractes following, beginning with the most compounded parts, and so proceeding till we come vnto the the most Simple and

Similar.

The end of the Ninth Booke of the Ioynts.



Of Flesh, that is, of the Muscles, the Bowels and the Glandules.

THE TENTH BOOKE.

The Preface.

AS our ability, time and auocations have giuen vs leave, wee haue gone through our first diuision of the body of Man into the three Regions, Naturall, Vitall and Animal and the Ioynts. It remayneth now that we dissolue euery one of these into those parts whereof they are compounded, laying each apart by themselves that their Natures and differences may better appeare. In this *Analysis* or Resolution wee will first begin with the *Flesh*, which beside that it maketh the greatest part of the bulk of the Body, is also somewhat more compounded then the rest of the Similar parts. Next we will entreat of the Vessels, that is to say, of the Veines, Arteries and Sinewes; for these are the Riuer or Brookes which conuay the Blood, the Spirit, the Heat, the Life, the Motion and the Sense, into all the parts and corners of this Little world. Afterward we wil descend vnto the gristles, ligaments, membranes and Fibres: Parts, not onely Spermatieall and Similar, but also Simple, that is, not Organieall. Last of all we will come vnto the Bones, that is, to the foundation of this goodly Structure; the Pedestall or Columns vpon which the frame of the Body of Man is reared and whereby it is strengthened and supported. I know well that some Anatomists of the best note, haue in their deliuey of this Art quite inuerted this order which we haue proposed vnto our selues, beginning first with the Bones, and so ascending by the Gristles, Ligaments, Membranes, Vessels and Flesh, vnto the three Regions and the Ioynts: which Methode being *Geneticall*, wee conceyue to be rather the way of Nature then of Art; for Nature first lineth out of the masse of Seed, the warp of the body, and after with the woofe filleth vp the empty distances: first she layeth the foundation, raiseth the stories, bindeth the ioynts and plastereth the walles, till it come vnto a perfect building. Art on the contrary takes it asunder peece and peece, proceeding from that which is more to that which is lesse compounded, till at length it come vnto the very ground-woke or foundation. This Method we haue followed till we are come vnto the Flesh: Of which there are three kinde; one of the Muscles, another of the Bowels, and the third of the Glandules.

To the declaration of these three we haue destined this Booke, but begin with the Muscles, because they are more compounded then the rest.

CHAP. I.

What Flesh is, and how many sorts of Flesh there be.



Flesh in Latine *Caro*, in Greeke *σάρξ*, hath diuers acceptions amongst the Ancients.

Sometime in a strict and proper acception it is taken for the flesh of a muscle, as if a muscle and flesh were both one thing: so Hippocrates vnderstandeth it in the 16

The diuers acceptions of Flesh.

Aphorisme of the 5. Sect. where he saith, *That bathes of hot water will loosen the Flesh*, that is, dissolve the strength of a muscle: and in the 2. Section of his Book *de Fracturis* he calleth the muscles absolutely flesh, because their chiefe part is flesh. But most plainly of all in his Book *de Arte*, where he saith, *All those members which are compassed about with flesh, which flesh they call a muscle, all those parts I say, haue bellies*.

Flesh and a muscle all one.

Sometime by flesh we vnderstand that simple part which is peculiar and proper to each part of a mans body, and compasseth, gathereth together, & couereth the *Stamina* or fibres defending them against the rage of the naturall heate, which would consume and depopulate their very substance, as also against the heate and cold, and other outward occurrents.

The particular flesh of euery part.

Concerning this flesh Hippocrates in his Book *de Ossium Natura* hath this saying, *The Flesh is that which tyeth together and buildeth or reareth up all the parts of this frame*. We out of Galen and the late Writers do take knowledge of 4. distinct differences of flesh; one is flesh properly so called, another is the flesh of the bowelles, the 3. is the peculiar flesh of euery part, and the 4. the flesh of the Glandules or Kernels. The flesh properly so called is a soft and ruddy part made of blood moderately dried, and is therefore called a bloody part and a hot part: such is the flesh of the muscles, which is truly and absolutely called flesh, such is also the flesh of the Gums and that in the nut of the yard.

4. kinds of Flesh.

What is Flesh properly so called.

The flesh of the bowels *Erasistratus* calleth *parenchyma*, as it were an affusion or gathering together of blood. For hee thought that the substance of the bowels did accrue or gather of blood yssuing out of the veines. But wee thinke that the bowels haue a proper substance of their owne which is the principall and chiefe part of the bowell to which his action doth properly belong. There is also another flesh peculiar vnto euery solide part, which flesh hath no proper name, but Galen calleth it *Carnosam substantiam*, the fleshy substance: for in the 10. book of his Method he acknowledgeth a double substance in the solide parts, the one exquisitely solide and fibrous altogether without blood, another with stuffeth the fibres & filleth vp their distances, and is called the proper flesh of euery part, this he thinketh is neuer restored if it be lost but onely moystned and cherished when it is present. Such is the flesh which is to be seene in the stomach, the guts, the gullet, the bladders and the wombe. And such a kinde of flesh, *Theophrastus* attributeth vnto plants growing about their woody, and as it were sinnowy fibres.

The Flesh of the solide parts.

A two fold substance of the solide parts.

The common vses of this three-fold flesh Galen hath described in his 12. Booke *de vsu partium*, to wit, that it should defend the parts from heat and cold and other outward occurrences. For al flesh is a soft pillow for the creature when it eyther lyeth or falleth down; when it is wounded it yeldeth to the hardnesse of the weapon; when it is bruised or beaten it filleth vp the breach as it were a boulder of Lint: in the sweltering heat of the Sunne it serueth for a shadow, and in the violence of cold it keepeth warme. And these vses I haue called *Common*, because there are other peculiar to each kind of flesh: for the flesh of the muscles both moueth voluntarily and also by his stuffing it hindreth the chord or tendon of the muscles, least when it is contracted or drawne together it should depart from the body, as also it easeth and moystneth the drowth of the nerues and ligaments, which they continually acquire by their perpetual motion.

The common vses of Flesh.

The particular vses of the flesh

The flesh of the bowels as it were a certaine stuffing or concretion, i. confirmeth the vessels of the bowels, next it filleth vp the empty places betwixt the vessels; and lastly it performeth a similar and official action as we shall say anon. Finally there is a glandulous flesh, such is the Pancreas a kernelly body placed in the belly neere to the gate of the liuer: for some haue defined a glandule to be a masse of flesh rowled vp in it selfe. And these in my iudgement are all the differences and distinctions of flesh. The particular history whereof, we will as accurately and briefly as we may describe vnto you in this following discourse, beginning with the flesh of the muscles, as being a more compound and organically part, and so proceeding to the bowels and glandules, which are more simple and similar, originally deriued from the first conformation of the body.

The Flesh of the Glandules.

The order of this Booke.

CHAP.

CHAP. II.

Of the Flesh of the Muscles, and what a Muscle is.

THe first and chiefe kind of flesh, is that of the Muscles, in the description whereof because of the variety and difficulty of the subiect, we must craue a little leaue somewhat to enlarge our selues. For it is far and wide spread over the whole body, and maketh indeed the greater part thereof. This is that which giueth strength, proportion, and beauty to all the other parts, whereof if the body be dispoyled, as it happeneth in the melting and dissolving heate of a hecticke ague, there remaineth nothing else but the image of a dead creature, nay of a dried and parched carcasse: which may seeme to be the reason that moued Hippocrates to call his Book wherein he treateth of the principles of the body and the nature of the particular parts (a work which he composed in his old age, as appeareth by the experienced certainty, maiesty and weight of the sentences therein contained) *de carnibus* a Book of flesh. The flesh therefore when it is gathered together on a heape Hippocrates calleth a Muscle in his Book *de Arte* as we haue said before, and againe the muscles hee calleth absolutely Flesh, because the principall part of them is the flesh. And in his prognosticks from the laudable and commendable habit or proportion of this musculous flesh, he gathereth the perfect health of the whole body. And in the 4. section of his Aphorismes and the 16, when he would describe a haile body, he maketh mention only of this flesh, where he saith, *Ellebor is dangerous to such as haue sound flesh*, that is, such as are in perfect health. For the muscles are a kind of part both governing and being governed: they gouerne those members for whose motion they were ordained, and are governed by the Braine through the nerues, by the Heart through the arteries, and by the Liuer through the veines: wherefore if these be in good plight (which is easy to be knowen by the naturall figure, fresh and flowry colour, and their iust and due extent) they show that the principall parts are in a good and commendable constitution. The nature therefore, differences and actions of these muscles wee haue taken for our present taske; wherein how fairely fouer we shall acquite our selues, yet wee make account as in all other parts of this labour, so especially herein, by reason of the difficulty to finde the truth and diuersity of mens opinions; we shall expose our selues to manifold censure and exception, vnlesse wee light vpon the more equall Auditors. But to the matter.

A Muscle is called in Greek *μῦς*, that is, a *Mouſe*, eyther because it is like vnto a fleine Mouſe, or vnto the Fish which they cal *Musculus*. It hath also diuers Latin names, one from the Greek, which is *Musculus*, and that we will incorporate or infranchise into our English, although the next Latin name, which is *Lacertus*, in English a Brawne, might reasonably well be retained, had not vs made this other more common. For we call an Arme full of sound flesh, a *brawny Arme*: but to hold the name of Muscle. There is a double consideration to be had of a muscle; the first is, of the structure or composition of it, the other of the office and vse: and therefore there may be a double definition giuen of it.

If you regard the structure, it is defined by Galen in *Arte parua*, *A flesh wouen of simple flesh and similar fibres*. And in the Book of Physicall definitions it is called *A sinowey body mingled with flesh*. It may more fully be defined thus: *It is an organicall and dissimilar part wrought together of Nerues, Flesh, Fibres, Veines and Arteries, all covered or inuested with a proper coate of his owne*.

That it is Organicall, Galen teacheth in his Book *de differentijs morborum*, in which place he reckoneth it among those Organs which are most simple and of the first kind, because it is not made of dissimilar particles but of simple.

That it is Dissimilar, the structure or the parts being of diuers kinds do evidently proue. The nerues are the conuayers of the spirits & the faculties; the flesh stuffeth the distances between the fibres that they should not be mingled, tempereth the drynes of the nerues and tendons, preferueth the threds or fibres that they be not bruised or broken, and maketh the Animall spirits more apt to moue by his heat. The Fibres which are wouen of small particles of the ligaments diuersly disheued do strengthen the flesh, establish and preferue it that it be not dissolved; the veines like small riuers, are provided only for nutrition; the Arteries do conserue the heat; the coate inuesteth the muscle, containeth his substance, separateth & distinguisheth it from the adioyning parts and giueth it the sence of feeling. This is the structure of a muscle, according to them all, to them alone and at all times.

There

There is another definition of a Muscle taken from his office which *Galen* delivereth in his first Booke *de motu musculorum*. A muscle, saith he, is the instrument of that motion which is performed with violence, or a Muscle is the immediate organ of voluntary motion. By violence *Galen* understandeth that which *Aristotle* calleth *Spontanum*, or voluntary which proceedeth from an inward principle, to wit, from a desiring or moving faculty. *Galen* calleth that which is Voluntary often times Animal to distinguish it from that which is Naturall: and in his Booke *de tremor: palp.* he calleth Muscles Organs which are moved at our discretion.

The explication of the definition.

Now that motion is Voluntary which at pleasure we can appease, and againe excite or stirre vp when it is appeased, and make it swifter or slower, rarer or quicker as we list.

What is voluntary motion. A double will from election and from instinct.

This will or pleasure of man is double; one from Election, another from Instinct: the first wee exercise when wee are awake, the latter when we are asleepe or minde some other matter more. The first is a stretching or Tention not without strife or contention, the second is in remission or rather the remission it selfe of that contention or strife; and therefore they that are asleepe do neyther moue their bodies into extreame and violent figures or postures, neither doe they accomplish the perfect *Tonicall* motion, that is, the stedfast holding of the member, as those that are awake.

Of this Voluntary motion there are diuers instruments, the Braine, a Sinew and a Muscle, but one is immediate. The Braine commandeth, the Sinew or Nerue carrieth the commandement, and the Muscle obeyeth. The Braine determineth of the object which is to be desired, whether it be profitable or noxious and hurtfull, to be followed or avoided: from hence therefore is the beginning and originall of the motion. When the action is agreed vpon by the Braine, the Nerue which is the spirits vehicle carrieth downe the faculty of moving: the Muscle being illustrated or enlightened with the beames of the spirit is presently contracted and immediately moueth the part according to the diuersity of the commandement which it receiueh from the will. And as a horseman hauing the reynes in his hand dryueth forward or reyneth in the horse, so the fantastick power of the Soule sitting in the Braine, by the nerues as by a reyne or brydle moueth the muscles.

Three organs of motion.

How these 3 do worke.

An apt comparison from a man on horsebacke.

These things therefore are necessarily required to locall and voluntary motion, which in order doe follow one another. An object appetible or to be desired, The faculty desiring, and a power to moue locally The Braine, the Animall spirits, the Nerues and the Muscles.

We conclude therefore that a muscle is the immediate instrument of voluntary or willing motion, whatsoever can be objected against the truth of this definition should haue receiued satisfaction in our discourse of the Controversies belonging to this Booke; but the volume groweth already so great that wee are constrained to forbeare the annexing of them in the three last books.

CHAP. III.

How many and what are the parts of a Muscle.

THe parts of a Muscle we wil distinguish into similar of which the whole body of the Muscle is composed; and dissimilar into which the same body according to his length is deuided.

The parts of a muscle.

The similar parts are Nerues, Fibres, Tendons or Chords, Flesh, Veines and Arteries. The dissimilar are three, the beginning, the middle, and the end; or the *Head*, the *Belly*, & the *Taile*. Out of these similar parts ioyned together and diuersly intangled with an admirable arte, resulteth an organ ordained for voluntary motion. But in this composition there is not the like worth or vse of al the particles, neither doe they meet together in the same degree or efficacy of operation.

Wherefore as before in euery perfect organ we obserued foure kinds of parts; the first of those by which the action is made originally and essentially; and to these *Galen* attributeth the preheminance or superiority: the second of those without which the action goeth not forward; the third by which it is better performed; the last of those which doe conserue the action or keepe it (as we say) in tune: so all these foure differences of parts a diligent Anatomist may obserue in a muscle. The fibrous flesh is the prime and principall part of a muscle, and as *Hippocrates* and *Galen* doe beleue the proper substance of the same: for if you reuiew the whole body you shall finde none like it; when that is wanting or decayed the motion also is weake or none at all, and where it is there also is alwayes voluntary motion: this

In all organs 4 kinds of parts are to be obserued.

The flesh is the principall part of the muscle.

this only is prepared and fitted by Nature to receive the influence of the *moving quality*: this alone doth easily collect, contract and gather vp it selfe together, and looseth and remitteth the part which it hath drawne: so also the chiefe part of all the bowels is said to be their flesh or *parenchyma*.

The Nerues which are diuersly dispersed into the muscles, are those without which the motion cannot bee: for they are the conuayers of the Animall spirits, and bring down from the throne or tribunall of the Soule, which is the Braine, the warrant & commandement to moue: if they be cut, obstructed, refrigerated, inflamed, or any other way affected, the motion perisheth instantly. The Ligaments and Tendons do make the action more perfect; for the tendon is not as we say in Schooles *simpliciter*, that is, originally and by it selfe ordayned for motion, but *secundum quid*, that is, for the performance only of vehement, strong and continuall motions, and therefore there be very many muscles without tendons.

The Veines, the Arteries, and the Membranes, are they which conserue the action, for the veines and arteries do restore the wasting and decaying substance of the muscles, which by reason of continuall expence are washy and fleeting: and therefore they are in great abundance dispersed through the flesh, because as *Hippocrates* saith *Flesh is a drawer*, and the blood ought to be in greater quantity then the rest of the humors because the maintenance of the muscle ariseth thereby. The membrane as it were a garment or couering inuesteth and closeth the muscle and giueth it the sence of feeling. And thus much concerning the nature of the similar parts of which the muscle is formed.

Now the whole body of the muscle is diuided into three dissimilar parts, the *Head*, the *Belly* and the *Taile*.

The Head is most commonly neruous, sometimes but rarely fleshy: for it is made of ligaments arising from the bone, yet it is not altogether insensible because of the insertion and interposition of the sinews, for it is couered with a peculiar membrane.

The Belly is the middle part of the muscle almost all fleshy, & maketh the bulke of the same: and for that reason in the leg they call the pulpe, that is, the brawne of the Calf wherein the middest of all the muscles of that part doe so meete that they seeme to make but one muscle, they call it I say *γαστρονύμιον* as it were *the belly of the Leg*, we call it the Calf.

The last part of the muscle is the End, the Taile or the Tendon, it is called *ἀκρονύμιον*, because it is almost altogether neruous. *Galen* thinketh that the Tendon is framed of the fibres of the nerues and ligaments confounded and mingled together, yet so that there are more fibres or strings of the Ligaments then of the Nerues, whence it is that the tendon is sixe yea ten fould thicker then a nerue.

And the reason of this mixture is because the ligament of it selfe and his owne nature immouable and insensible, could not alone performe a voluntary motion: and againe the nerue because of this softnes and flight or thin texture was not able to draw the vast bulke or magnitude of the members: and therefore it behoued to make of them both a mixt organ which should be harder and stiffer then the nerue for strength, and softer and more pliable then the ligament for motion: & such is a tendon partaking of the nature of them both, so becoming of a middle disposition betweene them; more sensible and weaker then a ligament, stronger and lesse sensible then a nerue.

Furthermore, we must remember that all muscles haue not tendons or chords, as the muscles of the Tongue, the Testicles, the Lips, the Fore-head, the Yard and the 2. Sphincters: but only those which are moued eyther strongly, or vehemently, or continually. Those that are ordained for the motion of bones, do alwayes end and determine into tendons eyther greater or lesse, and are inserted not into the iuncture or very ioynt of the bones, nor into the ends of that bone from which they arise, but for the most part into the head of the bone which is to be moued wrapping it about. The muscles also which moue continually though their motion be neyther strong nor vehement, yet they stand in need of a tendon: and therefore the muscles of the eyes are not without them.

The tendons make the action more perfect.

Hippocrates.

3. dissimilar parts of a muscle.

The Head.

The Belly.

The Taile.

Whereof the tendon is made.

The reason of the composition.

Why the small muscles of the eyes haue tendons.

CHAP. IIII.

what is the action of a Muscle, and the differences of the motions thereof.

 Muscle as it is an Animall Organ hath one and but one action, to wit, Motion: the Nature of which motion is not obuius or easily knowne of all. *Galen* in the 8. chap. of his 1. Booke *de motu musculorum* acknowledgeth foure differences of motions in these words: *The muscles are eyther contracted or extended, or sinke of themselves, or else remaine streatched or distended.*

There are 4. motions of the muscles.

Contraction is the proper and ingenit action of the muscle; for whilst it moueth any part whether it houldeth it stedfast when it is bent, or bendeth it being before stretched or distended, it is alwayes contracted or drawne vnto his owne originall, that is, towards his head. Now that contraction is the proper action of euery muscle, hence it appeareth that if the muscle be cut atwo in the middest ouerthwart his body, you shall see the one part contracted vpward and the other part contracted downward.

The 2. motion of the muscle is extention, which is not proper but aduentitious or accidental: for when the contracted muscle is extended it is loosened by another and not by it selfe: and therefore almost euery muscle hath ioyned vnto him a companion, nay rather an *Emulus concurrent* or aduersary, because it is the author of a motion contrary to his: As for example, euery flexor or bending muscle hath a tensor or extending muscle; euery adductor, that is, which moueth toward hath an abductor which moueth forward; euery leuator or lifting muscle hath a depressor or sinking muscle. When as therefore a muscle which is contracted is also extended, in this extention it followeth the motion of his *Antagonist* (for so we vse to call them) or aduersary, so that the extention is not the proper motion of the muscle that was contracted, but rather his passion then his action.

Extention the 2. motion of the muscle.

Note this.

There is a third motion of a muscle which is yet more improper, in which it is neither contracted nor relaxed but falleth with his owne weight, and this is called *translation* or *decidence* and sinking: this motion is not from the Soule but from the elementary forme, for the part not illustrated with the beames of the animall spirit falleth with his owne weight, and so the part is moued with the mouing faculty being at rest. So *Galen* saith that the tremor or trebling, which the common people call the shaking Palsey, commeth to passe by an equall contention or strife between the mouing faculty and the moued member, for the faculty listeth the member vp, and the waight of the member sinketh it selfe again, and so from that vicissitude or interchange of lifting vp and falling down commeth the trembling.

How trembling commeth

The last motion of the muscles we call *tonical*, wherein the fibres of the muscles are stretched and so remaine; so that the part seemeth indeed to be immouable but yet in truth is really moued. This motion is most euident in Birds when they fly or glide in the ayre with their wings stiffe stretched and seeming immouable; which motion *Virgill* expresseth excellently in the flying of a doue where he saith,

The last motion which is Tonicall.

Radit iter liquidum, celeres neque commouet alas.

A man also standeth by this motion, and so a Pisimre moueth vpward vpon a staffe as fast as the staffe descendeth downward.

Examples of Tonicall motion.

Of this motion *Galen* speaketh when he saith, that euen in sleep the muscles do moue. There are therefore in all 4. motions of the muscles, 2. performed by themselves, and those are contraction and the conseruation of that which is contracted which second motion is that we call *Tonicall*: for such is the Nature of successiue or succeeding motions, that they are no lesse accomplished when they are conserued then when they are first made.

2. motions per se.

The two other contrary to the former are by accident, to wit, Extention and Decidence; Contraction, Extention and the tonical motion haue sometimes extream sometimes middle figures or postures. All extream positions are painefull, those that are meane are easy or pleasant: the extream we cannot long endure vnlesse we bend our mind and power vnto it: the meane we easily endure when we thinke not of it. And therefore whilst we sleepe we very rarely suffer any extream flexions or extensions of the muscles, and then only when the fancy worketh exceeding strongly: otherwise the muscles are inclined rather then bent to eyther side, as *Hippocrates* obserueth in *Prognostico*: They lie (saith he) when they sleep with their Thighes, Hands, and Feete moderately reflected or inclined, because at that time the strength of the Animall actions is not ceased but only abated.

2. other per accidens.

Men

What the figure of the muscle is when it worketh & when it plaish

Men also in their sleepe haue not so strong Tonnical motions as when they are awake, as we may perceyue in the sphincter muscles which shut vp the wayes of the excrements, which performe indeed their Tonnical motion in a good sound sleepe, but if the violence of the excrement be great they either cease their motion and so the excrement auoydeth, or else the faculty being distressed calleth for more helpe, and so the party awaketh and becommeth more able to hold his owne. But it is worthy obseruation that all muscles when they moue are crooked, and when they rest are stretcht: and the reason is, because being contracted they become broader and shorter, and longer when they are relaxed: but from this generall rule, the muscles of the *Abdomen* and the *Intercostal* muscles or those betweene the ribbes are to be excepted, for when they are relaxed and the contention remitted they grow crooked, which I thinke happeneth by reason of the laxe and yeelding emptinesse of the chest and the lower belly.

CHAP. V.

Wherein all the differences of Muscles are shewne.

All the difference of muscles.
The first.



He Muscles do differ among themselves in their substance, quantity, figure, site, originall, insertion, fibres, parts, vse, and action. If you consider the substance, some are fleshy all ouer as the sphincters and muscles of the tongue: others are almost all nervous or membranous, as that *abductor* or forward muscle of the leg which is called *Membranous* or *fascia lata*, the broad Rowler.

The second.

The quantity considereth the dimensions; now dimension is threefold. Length, and hence some Muscles are long, as the right muscles of the *Abdomen* and the *Abductor* of the Leg, and some short. Breadth, and hence some are broad as the oblique and transuerse muscles of the *abdomen*, and the broad muscle which beareth down the arme, and others narrow: the last dimension is altitude whence some are thick, as the two large muscles called *Vasti*, and some are thinne or slender, so much for the quantity.

The third.

The figures of the muscles are manifold, some like a Mouse, some like a Snake, some like a Plaice. Again, some are triangles, some quadrangles, some five cornerd, some pyramidall or spiry, and some orbicular or round. To this kinde we may referre the Muscles called *Deltoides*, *Rhomboides*, *Scalenus*, *Trapezius* and such like.

The fourth.

From the situation, the diuision or difference of Muscles is very elegant: this site we consider in the position of the fibres and in the differences of place: from the position or tract of the fibres some muscles are right, some oblique and some transuerse. The oblique are most fit for oblique or side motions, the right for more exact flexion or extention.

The differences of the place according to the length doe make the muscles higher or lower: according to the breadth, right and left: according to the height, forward, backward, internal and external. Those occupy the inside which bend the part, and those the outside which doe extend it: and so much for the site.

The fifth.

In respect of the originall some arise from Bones, and these now from their heads or extuberations when they behoued to be greater; now a little lower or from the cauities, sometimes from one bone, sometimes from more; others from gristles, as the proper muscles of the *larynx* or throtle; others from a membrane incompassing the tendons or chords, as those which are called *Vermiculares* or the wormy muscles; others from other parts, as the sphincters.

The sixth.

The difference from the insertion is, that some are inserted into a bone, some into a gristle, as those of the throtle and the eie-lids; others into a membrane, as those which moue the eye; others into the skin, as those of the lips; others into other bodies: some also there are which hauing distinct originals do yet end and determine into one part: and some againe hauing but one originall are inserted into diuers parts. And so much of the insertion.

The seventh.

Now if you marke the texture of the fibres, they are of one kinde almost in all muscles: and yet there want not some which haue two or three kind of fibres manifestly appearing in them, as that which is called *Pectoralis* and *Trapezius*, as also the muscles of the lippes, from whence come their diuers and different motions.

The eighth.

The eighth difference of Muscles, is from the diuersity of their parts; now by parts in this place I meane both the especiall parts of the Muscle it selfe, and those parts or places wherein such muscles are seated. The parts of the Muscles are three as wee haue sayd, the Head

Head the Belly and the Tayle. Most Muscles haue but one Head, some two, and some three, from whence they are called *Bicipites* and *Tricipites*. The Belly sometimes is one and sometimes two as in the Muscle which shutteth the lower Iaw and that of the bone *Hyais* which is at the roote of the Tongue, which Muscles from their double bellies are called *Digastrick*. The Tendon is in some broad and membranous, in others round, in some short, in others long, in some perforated; in others there is none at all, in others but one, and in others many Tendons: sometimes also you shall perceiue diuers Muscles to determine in one Tendon, as in the leg of the *Twins* and the *Soale* is made one Chord or Tendon.

From the parts in which the Muscles are seated they haue also names to distinguish them from others, as *Crotaphita* or temporall Muscles, *Rachia* or *Spinati*, that is, *Thorny* Muscles, and *Iliaci*, that is, Muscles of the *Ilia* or *Flankes*. Finally the most necessary difference of Muscles, as I thinke, is taken from their vse and action. The action of the muscle is voluntary motion: therefore according to the variety of their actions shall be the differences of the Muscles, which I am wont to referre to three especiall ones. The first shall be this. Muscles are eyther of a kindred, or of an aduerse faction. I call those a kin which do conspire & agree into one and the same worke, as the two *Flexors*, and the two *extensors*, the one of which vseth to occupy the right, the other the left side. Those of the aduerse faction are called *Antagonists* opposites or *Concurrents*, which performe actions contrary or succeeding one to another. For euery Muscle almost hath set vnto him another, whose action is contrary to his, as to a *flexor*, is set a *tensor*, to a *levator* is set a *depressor*, to an *adductor* is set an *abductor*; onely we must except the two *spinners*, and the *Cremasters* or hanging Muscles.

Those that are a kin are almost alwayes alike in magnitude number and strength, but the opposites are not alwayes so equall, but vary much according to the weight of the part which is to be mooued, or the vehemency of the action. So they are but two which bow the head, but to stretch it out and lift it vp there are twelue. Againe, there are many which close the neather Iaw, and but onely two that open it: for heauy things or parts do easily fall with their owne weight.

Of these Muscles which are of a kin *Galen* hath left this rule. *As often as those muscles which are of a kinne are in opposite parts equall in number, magnitude and strength, the resolution of one makes the conuulsion of the other.* And of the opposites or *Antagonists* he writeth thus in his first Booke *de motu Musculorum*. *Of those motions that succeed one another if one perish the other must needs be taken away. For if that which extendeth be cut a sunder, the part indeed shall be contracted or bent, but it shall alwayes so remaine because the muscle that should extend is cut a sunder.*

The second difference of Muscles taken from the variety of their motion or action shall be this. Some Muscles moue themselves, others other bodies. They which moue themselves are *spinners* of the fundament and the bladder: they which moue another body beside their owne moue a bone, or some other thing then a bone. Those which moue a bone doe end in Tendons either greater or lesse: they which moue another thing beside a bone, some of them haue Tendons, and some haue none. They which moue such parts as are easily moued haue none, because their motion is not vehement, as the Muscles of the Tongue and of the Testicles; but the Muscles of the Eyes haue Tendons, because being continently and perpetually mooued, though it be but a small part yet it needs a strong moouer.

The third difference of the Muscles taken from the variety of their actions respect to their peculiars motions which are diuers; from whence they are called *Flexores*, *Tensores*, *Attollentes*, *Deprimentes*, *Adductores*, *Abductores*, *Rotatores*, *Circumagentes*, *Masseteres*, *Cremasteres*, *Spinneres*. That is, *Benders*, *Stretchers*, *Heauers*, *Sinkers*, *Tow-ward*, *Fro-ward*, *Rowlers*, *Compassers*, *Mangers*, *Hangers* and *Binders*.

CHAP. VI.

Of the number of Muscles.

THe Authors of Anatomy haue not agreed vpon their verdict concerning the number of the Muscles, neither to say truth is the euidence so pregnant as to ingage a mans faith; some doe acknowledge more, and some fewer, some there are which looking with spectacles make many of one, and these increase the number, happily beyond the stint of Nature; some againe are so thicke figured that of many they make one.

Sff

We

Of their place

The d. from
their vse and
action.
From the va-
riety of action
2. differences.
What muscles
are a kinne.
What are An-
tagonists

A rule concern-
ing muscles
that are a kinne
Another concern-
ing oppo-
sites.

The 2. differ-
ence of the
muscles taken
from the actions.

The third dif-
ference.

The number of
the muscles is
uncertaine.
Silvius his
names.
The muscles
are 405:

A briefe enu-
meration of all
the particular
muscles.

Wee in this one Chapter will comprise the whole Forrest and confusion of Muscles into a briefe summe. *Silvius* hath given them almost all proper names, either from their action, vse, figure, or the similitude of some outward thing, which because they seeme to represent the matter with more life, and are beside a great helpe to memory, wee will retaine them in our History.

The Muscles therefore in the whole summe are foure hundred and five. First 2 of the forehead, 6 of the eye lids, on each side 3. two doe open them, and foure shut them. The Eye is rowled after a strange volubility by 12 Muscles, 6 in each eye, the *beauer*, the *sinker*, the *too ward*, the *fro-ward*, and 2 rowlers.

The outward Eare is moued by sixe, 3 the right and 3 the left: two dilate the Nostrils and 2 contract them. The Lips haue nine, 4 moue vpward and as many downward, and the ninth is called *Buccinator* or the *Puffer*, *Winder*, *Sounder* or *Trumpeter*. The lower Jaw hath tenn which moue it vpward, downward, forward, backward and on both sides. The bone of the Tongue called *Hyois* (if at least it may be called a bone) 8 muscles doe suspend and establish. The Tongue is moued like an Eele, vpward downward, forward backward and to the sides, by 10 muscles. The Chops haue eight, 4 on eyther side which helpe the swallowing. The *Larynx* or Throttle is dilated, constringed, opened and shut by 14. foure common and ten proper. The Head hath likewise 14: sixe greater and 8 small ones. The Necke hath eight, 4 to bend it and as many to extend it. The Shoulder-blade hath all his motions performed by 8 peculiar muscles, foure in each shoulder-blade, *Trapezius*, *Leuator Proprius*, *Serratus minor* & *Rhomboides*, that is, the Table, the proper Heauer, the lesser Saw and the Plaine. The Armes are each of them moued with 8. their names are *Deltoides*, *supra-spinatus*, *latissimus*, *rotundus maior*, *pectoralis*, *infra spinatus*, *rotundus minor* & *subscapularis*, that is, the halfe Lozenge or triangle; the Ridge blade or blade-ridge muscle, the broad muscle or Pruritane or claw backe, the great Bowle, the Pectorall, the Snaile, the lesser Bowle and the Lurker. The Cubit hath foure, in each 2 benders and 2 stretchers: the 2 benders are called *Biceps* & *Brachialis*: the 2 stretchers are called the *Long* and the *Short*. The *Radj* haue each of them foure, two fore-bowers, the *round* and the *square muscles*, and as many backe-bowers. The Wrist is bent by two, and extended by other two. The Fingers (excepting the thumbe) haue 3 benders, *Palmaris*, *Sublimis* and *Profundus*, the Palme muscle, the Floating muscle and the Deep muscle; and foure stretchers; 4 *too-ward* which are called *Permiculares* or the wormes, and 6 *fro-ward* called also *Interossei*, because they ly among the bones; in all 17. The thumbe hath nine, 1 bender, 2 stretchers, 3 *too-wards*, and as many *frowards*. There is also in the little finger a peculiar muscle which moueth it froward the rest, so that in each hand there are 27.

The Muscles seruing for Respiration are in all 65. of which 32. doe distend or dilate the Chest, and as many contract it. Valuable to all which for both vses is the odde Midriffe. As for those 11. internall and externall, which are fancied to be betweene the gristles of the ribs we doe not acknowledge them saith *Laurentius*. The *Abdomen* hath 10. muscles, 4 oblique, 2 right, 2 transuerse and 2 small or pyramidall muscles. The backe is moued by ten, 5 on each side. The Fundament hath foure, 2 *sphincters* and 2 *beavers*. The Bladder hath 1 *sphincter*. The Testicles haue 2 muscles called *Cremasteres* or hangers and suspendors. The Yarde hath 4. The Thighes are each of them bent by two called *Psoas* and *Iliacus*, and three stretchers, which are they that make the substance of the Buttocks, there also are *too-ward* muscles and 6 *froward*, 2 *obscurores*, and 4. twinnes called *quadrigemi*, wherefore the muscles of the thigh are in all 28.

The Legge hath foure benders called *postici* or the posterne muscles, and so many stretchers, the right, the 2 *Vast* and the *Cruriens*; two are *too-ward*, the *Long* and the *Ham* muscles, and 1 is *fro-ward* called *membranofus*, so that the muscles of the Legges are 22.

The Foote hath two that bend it, that is altogether in the in-step called *Tibialis anticus* and *Peroneus*, and 4 which stretch it, 2 twinnes *Soleus* and *Plantaris*.

The Toes haue 2 benders, *Sublimis* & *Profundus* and 2 stretchers, 4. *too-wards* called the *Wormes*, 8 *fro-wards* called *Interossei*. The great Toe hath 1 bender, 1 proper stretcher, 1 *too-ward* and another *fro-ward*. There is also one peculiar *fro-ward* muscle of the little Toe, so that in each foote there be 21. muscles for the moving of the Toes. The totall sum of all these in the whole body is 405. whether thou wilt add more or make these fewer, for my owne part saith *Laurentius* I do not greatly care, no more do we, but haste vnto our peculiar History of the Muscles of each part, beginning with those of the Head.

CHAP. VII.

Of the Muscles which moue the skin of the Head.

WE haue saide before that the skinne of the Head is moued according to our good pleasures, in some men all of it round about, but in most onely the skin of the forehead and the face. The Ancients, as *Galen* for example (in his 11. Booke *de usu partium* and the 15. Chapter) thought that this motion came from a thin and musculous substance which is subiected or lyeth vnder the skin of the forehead and is vnited thereto as the palmes of the hands and Soales of the foote are vnited with their Tendon. But the late writers with more euidence of truth by curious obseruation haue found out and allotted to euery part of the face his peculiar muscles, for we call all that the face that may bee seene outwardly. Some of these are in the forepart of the face as the forehead, the Eye-lids, and the nose: others in the backpart of the head called *occipitium*; some on both sides, as in the lips and the cheekes.

The skin of the forehead (which by his tension and corrugation, that is, smoothnesse or wrinkling demonstrateth the manifold affections of the mind) is moued not onely by the helpe of the fleshy membrane, growne more fleshy as *Vesalius* thought (and so being vnited to the flesh vnder it, passeth into a musculous substance furnished with right fibres) but also by two muscles, as appeareth both by the course of their fibres and by their motions; the fibres appeare in these after the manner of other muscles, and their motion is not like the motion of the fleshy membrane.

Fallopins also and *Platerus* haue given them names. *Fallopins* calleth them the first paire moouing the skin of the head, and *Platerus*, the muscles of the affections. These are seated in the forehead, and doe arise aboue where the haire determines sometime as high as the crowny seame neare the temporall muscles, the right at the right and the left at the left temple (where the fleshy membrane cleaueth so close to the scull-skin and the scull it selfe, that it is altogether immooueable, that the forehead and the eye brows might be mooued when their membrane is at rest) and toward the common seame which distinguisheth the bones of the head from those of the vpper iaw, are implanted with right fibres aboue the eyes and the nose into the skin at the brows, as at the parts which are to be moued: for when the brows are mooued they draw in a straight line together with them the skin of the forehead. I saide right fibres and not oblique as some haue thought, and therefore Chirurgions must obserue that in opening apostemations in that place, they make not their incisions ouerthwart as the wrinkles of the skin doe goe, but according to those right fibres.

Wee must also obserue that these two muscles are a little disioyned in the middest toward the top of the forehead, and that is the reason why the vpper part of the forehead is not mooued; but at the top of the nose (where also they become more fleshy) they are so ioyned that they seeme to be but one muscle. But that they are two, not onely Anatomie but also reason and experience do teach; reason, because Nature hath made all members double that the body might be equally ballanced: Experience, because we finde that if one of them bee eyther taken with the palsey or wounded ouerthwart, the affected side onely looseth his motion and not the other, whereas if there were but one, there should bee no motion at all. And *Columbus* maketh mention of a Cardinall whose left muscle suffering convulsion by reason of a wound he receiued aboue his brow, did notwithstanding moue the halfe of his forehead. Againe, when we are mooued to displeasure, wee contract and wrinkle the skinne in the middle of the forehead, so that the browes doe almost touch one another: which contraction of the skin could not be made if there were but one muscle.

The vse of these muscles is by the contraction of their fibres to lift vp the browes together with the skin of the forehead, and vpon their relaxation to settle them againe. For the forehead is mooued as *Galen* elegantly discourseth in his 11. Booke *de usu partium* and the 14. Chapter because of the eyes: for when the forehead is lifted vp the browes also fly vpward and the eyes are better opened to see more at once. And againe, when the eyes are shut for feare of any thing which should rush vpon them, they are better and more strongly closed by the falling of the browes and the forehead. The muscles which draw the skin of the head backward are two, on either side one, arising very slender from the transuerse line of the *occiput* or nowle of the head, into which line the second muscle of the shoulder-

Galen.

What we meane by the Face.

The skin of the forehead sheweth the affections of the mind

A good note for Chirurgions in opening apostemations in the forehead

That there are 2. muscles.

The vse of these muscles:

The muscles which draw the skin of the head backward.

Why some men
can moue the
skin of their
head.

Aquapendens
his muscle of
the eye-brows

blade called *cucullaris* or the Cowledoth determine: from this line doe run fibres directly vpward and make these muscles, which are very short and not aboue an inch, but yet so broad that either of them toucheth the eare of his owne side, and they end into a thinne and broad Tendon, which seemeth to be made of the fleshy membrane, and occupyeth or compasseth the whole head and the fore-muscles of the eare, and ioyneth also together the muscles of the forehead. The vse of these two muscles is to draw the Skin of the Head backward; and therefore *Columbus* thought that they drew also the eye-brows and instanceth in the example of one *Iohannes Antonius Platus*, who could moue the whole skinn of his head very strongly as also could *Columbus* himselfe. But as the muscles of the forehead are neuer wanting, so these of the nowle and the fore-muscles of the eares (as *Falopius* and *Platerus* haue also obserued) are but seldome found.

Beside these *Aquapendens* ascribeth to the eye-brows a round muscle differing from the circular muscle of the eye-lids, because that of the browes hath thicker and more fleshy fibres, and beside is somewhat larger; drawing the brow especially downward to the eye, and being like vnto a Ring attracteth also the lower lid very strongly.

CHAP. VIII.

Of the Muscles of the Eye-lids.

Great differences among
Anatomists
concerning
these muscles.



That the Motions of the Eye-lids are and their necessities, as also of what kind Voluntary or Naturall with other circumstances thereto belonging, we haue declared before in their History. Now concerning the number of these muscles whereby these motions are effected, I finde great difference between *Galen* and the late Writers, and amongst the late writers themselves.

Galen and the ancients with whome *Vesalius* and *Sylvius* doe agree do make two, deuinding the orbicular muscle of which we shall treat anon into two: one lifting vp the Lid, the other bearing it downe. *Laurentius* is of the same mind for the diuision of this muscle but not for the Vse, for he thinketh that they both serue to shut the vpper Lid: so that it should seem that *Galen* & those that side with him did not know of any muscle which should open the eye. *Falopius*, *Platerus*, *Bauhine*, *Laurentius* and *Aquapendens* affirme, that for the opening of the eye there is but one muscle. *Columbus* and *Archangelus* say there are two; the first we admit, the second we say serueth to rowle the eye. But to passe by these contentions you shall giue me leaue to resoluue the matter thus.

The place of
the right muscle.

The motions of the Eye-lids are performed by two muscles, one right in the vpper Lid which listeth it vp, and the other round. The right muscle (which *Galen* knew not, neither *Vesalius* nor *Sylvius*, but *Falopius* challengeth the inuention of) which listeth vp the vpper Lid [tab. I. M] is seated within the concavity of the bones in the vpper part of the orbe aboue and neare the muscle which listeth vp the eye to which in figure it is very like, and fleshy but lesse, and ariseth backward at the in-let of the opticke nerue from the same originall with the other muscles which moue the eye, and being directly stretched to the vpper Lid is inserted with a broad tendon into his end or cartilage. His vse is by contracting his fibres inward to draw the vpper Lid vpward (for the lower ferleth into his place of his owne accord) and so vncovering the eye it openeth it.

The orbicular
or round muscle.
His position.

The semicircular or round Muscle [tab. I. K] is seated betwixt the fleshy membrane and that which is produced from the *Pericranium* or Scull-skin, and is membranous and very thinne or slender, yet a little increased by certaine circular and fleshy fibres which he borroweth from the fleshy membrane, and so standeth halfe round in either Lid.

His originall.

It ariseth with a sharpe beginning at the roote of the nose in the great and inward angle of the lower Lid where the common future is betweene the head and the vpper iaw, from thence it proceedeth all along the latitude or breadth of the same Lid, and is instantly enlarged and returned to the outward angle toward the vpper part of the orbe, and passing on by the vpper Lid is inserted with a sharpe end into the vpper side of the inner angle, and so maketh an exact circle, compassing the outward circumference of both the Lids. Yet *Falopius* excepteth the inner part of the great angle, from which it is prohibited that it might not be altogether circular.

Progress.

And insertion.

His vse is, that being drawne toward his originall, it might at one and the same time moue

move the vpper eye-lid downeward and the lower vpward, thereby ioyning and binding them together. And that this is so, it appeareth as well by the continuity of the fibres in the circumference and in the angle, as also by the motion in the same angle, especially if it be a little more constrained so as we must needs winke something withall: and this may be manifestly perceived both by the sight and by the touch. For no-things ioyned can bee strictly drawne together so as they touch one another, vnlesse some parts bee drawne vpward and some downeward. This muscle in respect of his fibres (which are continual) is most truly said to be one, but in respect of the two lids may be called two semicircular muscles: for being separated they make a halfe circle, but ioyned together, they make it perfect. This muscle *Galen* knew, and in his Booke *de vsu partium* at the 9. Chapter, he prooueth how all the motions of the eye-lids are absolued by it, he deuideth it also & addeth, that one of them draweth to the great angle toward the Nose, and the other vnto the lesse toward the Eare, and that when the first draweth the lid is depressed, but lifted vp with the latter. But because the fibres of this muscle are continuall through the whole lid, although it also bee mooued vpward and downward, yet is there no muscle which hath right motion but onely this forenamed circular muscle, which draweth it vpward indeed, but rather toward the inward angle or corner, as it were to his beginning, as every man may perceiue by touching that part himselfe; and yet I know that some thinke this motion proceedeth from the motion of the cheekes.

The vse of this circular muscle

How this muscle may be said to be two.

Why it can bee but one.

Conclusion.

We conclude therefore that the motion of the eye-lids is accomplished by two muscles, one right, which being in the vpper lid eleuateth it; the other orbicular or round and is in both the lids, which when it is stretched doth at the same time draw the lower lid vpwards and the vpper lid downwards: and when there is need of a stronger contraction or closer shutting together; then also the orbicular muscle of the cie brows wherof we made mention before is drawne in to be assistant, like as when we would open the eye more staringly, the muscles of the forehead do much helpe vs.

He that would demonstrate these nice and curious muscles, must haue a very smal knife and very keene, wherewith he must first separate the skinn, in the meane time taking care that he doe not cut the fibres of the muscle, especially in the angles: then shall he separate the muscle below at the *Tarsus* or edge of the lid, and aboue at the eye brow. *Fallopins* in his obseruations confesseth that he was a long time of the same opinion with *Galen* and *Vesalius*, but in the year 1553. tooke knowledge of his error, being admonished partly by *Oribasius* in his Booke *de dissectione musculorum*, and the 29. Chapter, and partly by dissecting the eye of a fish called *Phoca*, which is the Sea calfe, which fish mooueth both his Eye-lids. But we proceed vnto the muscles of the Eyes.

How these muscles may be dissected.
How *Fallopins* came to learne the right muscle.

CHAP. IX.

Of the Muscles of the Eyes.

BEcause our Eyes were giuen vs as spies and scout-watches that wee might pursue profitable things and auoyde whatsoever is hurtfull, Nature made not them im-moueable, for then they should haue discerned only that which was opposite vnto them, for so saith *Aristotle* in his second booke *de part. Animal.* and in the 10. Chapter. We see *per directum*, that is, by a streight line not in euery position saith *Galen*, because oblique, side, backward, higher and lower objects do not fall in with the ball of the Eye. Wherefore it behooued they should be so disposed that they might moue and turne themselues on euery side at their pleasure. These motions according to *Galen* in the third Chapter of his first Booke *de motu musculorum* are fixe in number, and therefore each eye must haue fixe muscles; in beasts there are seauen, especially such as goe on all foure, which deceived *Galen* and some late writers, who were accustomed onely to dissect the Eyes of brute beasts, yet hath the Ape but fixe: The seauenth where it is, may be deuided into two, three or foure. In men, as I said, they are fixe according to the fixe motions of a mans Eye, fower of which motions are right, vpward, downward, to the right hand and to the left: two motions are oblique, to which belong two oblique muscles, whose vse is to rowle the Eye about: notwithstanding one of these is exactly oblique, the other partly right and partly oblique.

How many motions in a mans eye.

All these muscles are seated on the backside of the Eye within the cavity of the Scull whither they accompany the Opticke nerue: and so remaining in their position the Eye

The figure of the eye.

The quantity
of the muscles.

Divers opini-
ons.

Vesalius.
Platerus.
Bambanus.

Whence pro-
ceedeth the
white of the
eye.

and they together do make a pyramidall figure. [tab. 1. fig. 6. and 7.] Among these the thicker and more corpulent are the right Muscles, which have all the same structure, original and insertion, and do passe straight all along the length of the eye, the oblique are lesse fleshy. These Muscles are all small, that they might bee sooner mooved, but that which helpeth most the volubility of their motion is the round figure (which is the swiftest of all other figures as we may perceiue by the roundnesse of the heauens) for by it euen in a moment they are conueyed ouer the one halfe of the sky.

The foure right Muscles meeting towards the roote of the Nerue Opticke, doe arise with a sharpe beginning from the lower part of the Orbe which is made by the Wedgebone, hard by the passage through which the Nerue of Sight doth yssue.

I know there be some who imagine that they arise from a mixture of the *Dura Mater*, & a Nerue of the second paire. Others, from the Membrane which compasseth the Orb of the eye, and that other Membrane which inuesteth the Nerue Opticke: some from the *Pericranium* as *Aquapendens*, but we will rest vpon *Bambanus* opinion for their originall. Their whole bodies are fleshy, and they beare out their bellies round when they come forward, and a little aboue the middle of the eye they determine into a broad thin and Membranous Tendon, where-with they compasse the whole eye before, and grow very strongly to the horny tunicle neere vnder the Rain-bow in the great Circle: and these tendons ioyned together do make that namelesse coate of *Columbus*, and the halfe-transparent white of the eye: for I thinke that this whitenes is caused rather by the Tendons of these Muscles then by the coate which they call *Adnata* or the cleauing coate.

But we will giue you a more particular description of them seuerally. The first [tab. 2. fig. 1, 3, 4. D fig. 5. d] which is the third (according to *Galen* and *Vesalius*) is placed aboue, fleshy and round, thicker then the rest, and greater and stronger it is then the second, lifting vp the eye toward the browes: for there is more strength required to lift any thing vp then to pull it downe; it is called the *proud Muscle*, because the motion thereof lifteth vp the eye with a kinde of disdaine.

TABVLA II.

FIG. I.



FIG. II.



FIG. III.



FIG. IV.



FIG. V.



Table 2. Fig. 1. sheweth many Muscles of the eye in their own seat. Fig. 2. sheweth the eye rowled Spward whereby his Muscles may be perceined. Fig. 3. and 4. sheweth the Muscles of the eye separated before and behinde with Nerues. Fig. 5. Is the eye of an Oxe, with his Muscles seuered as *Vesalius* doth shew it.

- C, the Muscle lifting vp the eye-lid.
- D, 1, 3, 4. the right upper muscle of the eye in 3, and 4, with the Nerue.
- E, 2, 3, 4. The right lower Muscle of the eye in 3, and 4, with the Nerue.
- F 1, 2, 3, 4. The right externall Muscle of the eye.
- G 1, 2, 3, 4. The right internall Muscle of the eye.
- H 1, 2, 3, 4. The oblique inferior muscle or the pully, whose tendon is marked with a and the pulley with b.
- I, 2, 3, 4. The oblique inferior muscle of the eye.
- a 1, 2. The tendon of the oblique superior Muscle.
- b, The second Muscle of the eye-lid lying in the cavity of the eye, whose broad Tendon b is inserted into the eye-lid.
- c, 5. The haire of the eye browes.
- d, 5. Two right Muscles leading the eye vpward and downward.
- e, 5. Two right Muscles mouing vnto the right and left side.
- f 1, 5. Two right Muscles lightly turning the eye.
- x 1. The seauenth Muscle which may be diuided into more.

The

The second [*tab. 2. fig. 2, 3, 4. E. fig. 5. **] is placed in the lower part opposite to the first, and according to *Galen* and *Vesalius* it is the fourth: it draweth the eye downward towards the Cheeks, and therefore needed not to be so great as the former; for the eye declineth with his owne weight: it is called the depressor and the *bumble* Muscle, because in bashfulnesse we draw our eyes downward toward the lower lid.

The third [*tab. 2. fig. 1, 2, 3, 4. G. fig. 5. **] according to *Galen* and *Vesalius* the first, is seated in the greater angle, and leadeth the eye inward toward the nose, and is called the *To-leader* and *Bibitorius*, we may call it the *squinting* Muscle.

The fourth [*tab. 2. fig. 1, 2, 3, 4. F. fig. 5. **] the second according to *Galen* and *Vesalius*, is opposite to the third, seated on the outside of the eye which it draweth outward to the lesser angle or to the temples, and is called the *Pro-leader* or the muscle of *Indignation* or the *Wayward* muscle.

By these foure if they moue together the eye is drawne inward, stablished and contained, which kinde of looke wee in our language call a *wist-looke*, the motion the Latines call *Tonicall*.

The fift [*tab. 2. fig. 2, 3, 4. I. fig. 5. B*] is the fift also according to *Galen* and *Vesalius*, but the fift according to *Falopius*, *Platerus* and *Laurentius*. It is seated on the outside in the lower cavity, and ariseth betweene the eye and the tendons of the second and fourth Muscles (which is the reason why some haue thought that it taketh his beginning from the eye and is againe inserted into the same) from that cleft which appeareth like a suture of the bone of the lower orbe where the first bone of the law is ioyned with the fourth: sometimes it ariseth with a fleshy beginning from a bony scale.

It is slender, round, short and exactly oblique, and passeth obliquely toward the outward angle, as it were to embrace the eye with a short and somewhat round tendon, and is implanted with a thin and sinnowy end in an oblique line by the Rainbows side neere the insertion of the sixth muscle: so that sometimes the tendons of them both seeme one and the same.

To recite here the Altercations of Anatomists about this muscle would rather intangle our Readers then giue them any great satisfaction; especially seeing such learned men to whome so curious disquisitions will not seeme tedious, may repaire to those fountaines from whence we haue deriued these riuers: wee passe vnto the vse, which is by the contraction of his fibres to rowle the eye obliquely downward toward the outward angle.

The sixt [*tab. 2. fig. 1, 2, 3, 4. H. fig. 5. **] so also according to *Galen* and *Vesalius*, but the sixt according to *Falopius*, *Platerus* and *Laurentius*, is seated on the inside and the vpper part, yet vnder the right muscles, and is partly right and partly oblique. It ariseth from the same place with that which draweth the eye directly to the inner angle at the side of the opticke nerves passage on the backe of the orbe.

It determineth as well in man as in beasts into a round small and long [*tab. 2. fig. 1, and 2. **] tendon almost at the vtmost skirt or edge of the inward angle.

This Tendon is reflected through a small gristle hollowed like a cane or pipe, and placed in the greater angle which *Falopius* first of all found out, and called it *Trochlea* or the pulley, and thence proceeding obliquely to the right angle [*tab. 2. fig. 1, and 2, B, but in the 3, and 4. figure it is shiuen from the bone*] toward the vpper part of the eye, it is inserted betweene the first and the fift muscles somewhat oblique; all which time the foresayde Tendon is compassed about with a certaine Ligament as it were with a sheath. This Muscle (being drawne inward to his originall with his tendon) turneth the eye in a circular motion to the inward angle. These two the one aboue the other below, are called the *Rowlers* or the *Muscles of Loue*: the sixt also some call *musculus trochlea*, or the *Muscle of the Pulley*.

The seauenth Muscle which is for the most part found in brute beasts [*tab. 2. fig. 5. **] is set vnder the former fixe, and hath in it selfe that figure which the former fixe doe together make: it is short and compasseth round the opticke nerue [*tab. 2. fig. 5. **] yet is there some fat betweene them; proceeding forward it is dilated, embracing the whole globe of the eye at the roote; it maketh also a circle even as the foure first neare the Rainbow did make a circle with their Chords: at his insertion which is into the hard tunicle of the eye, it becommeth fleshy and may be deuided into 3, or 4. so as *Galen* doubteth whether it be one, or double, or treble.

The vse of this muscle is to tye vp and strengthen the eyes of brute beasts hanging

alwaies downeward that they should not fall with their owne waight; it also encompasseth the nerue optick making his passage more straight, so as in violent concussions or motions it may neither leane against the bone nor be indangered by distention.

Why a man
hath not the 7.
muscle.

This Musle, Nature or the God of Nature rather did not see needfull for man; because he hath a countenance erected vp to heauen; and if at any time he be constrained to looke downeward, he hath all the right muscles with their ioynt strength to sustaine the Eye, because they grow with their fibres to the membrane which compasseth the orbe.

How to make
diffetion to
shew the mus-
cles best.

To finde out the muscles of the eye, when the braine is taken away you must cut the orbe at each corner euen to the nerue opticke with a Saw, hauing a great care least the *Trochlea* or Pully which is in the inner angle be offended. Then you must separate the *Pericranium* from the bone, and breake the vpper part of the orbe backward, then take away the fat, and so shall you perceiue the muscles of the eye-lids and of the eyes themselues together with their vessels: and if you would obserue the proper and peculiar motion of euery muscle; you must preserue them in their proper position, and tye to euery one of them a thred not far from their tendons and then draw the thred. You may also take the eye whole out of the orbe together with the *Trochlea* which is in the inner angle, and so demonstrate what you please. And thus much of the Muscles of the Eye.

CHAP. X.

Of the Muscles of the outward Eare.

Although most commonly mens Eares are immouable, and few there be who haue any sensible motion of them; yet that the moouing faculty may flow into them, is manifest as wel by their muscles whose action is motion, as also by the nerues

Tab. 3. Fig. 1. Sheweth the muscles of the fore-head, the Eye-lids and the Cheeks.

Fig. 2. Sheweth the Muscles of the Nose, Lips, the lower Iaw and of the bone *Hyois*.

TABVLA. III.

FIG. I.



FIG. II.



A, 1, 2, The muscles of the fore-head and the right fibres thereof.

B, 1, 2, The temporall muscle.

a, b, 2, His semicircular originall.

CE, 1, The first muscle of the Eye-lidde compassing the whole lid.

FD, 1, The third muscle of the wing of the Nose which endeth into the vpper lip.

GH, 1, The muscle of the vpper lip.

I, 1, The broad Mouse-muscle stretched ouer the Cheeks and all the lower parts.

K, 2, The circumscription or circumference of this muscle.

L, 2, the grinding muscle or the 2 muscle of the iaw

M, 2, A muscle forming the Cheeks.

N, 2, The muscles of the lower lip.

O, 2, A part of the fist muscle of the lower iaw called *Digastricus*, that is, double bellied.

Q, R, 2, The first muscle of the bone *Hyois* growing to the Rough artery.

S, 2, The 2. muscle of the bone *hyois* vnder the chin

The lower T, in the second figure sheweth the third muscle of the bone *Hyois* stretched to the iaw. The vpper T, in the second figure sheweth the insertion of the 7. muscle of the head.

VV, 2, Two venters of the fourth muscle of the bone *Hyois*.

The backward K, (put instead of X) sheweth the seventh muscle of the head and his insertion at the vpper T.

x, a, 2, The original of the grinding muscle from the yoke-bone. u, 2, The insertion of this muscle into the lower iaw. p, o, 2, Two beginnings of the seventh muscle

of the head. T, 2, His insertion into the *Maxillary* proceffe.

which

which thereabouts are commonly seene. Now the reason why this motion is so rare and so hardly perceiued is three-fold.

The first, because the muscles of the Eares are so small (*Galen* in the 6. Chapter of his 16. Booke *de vsu partium*, calleth them but delinations of muscles) and the nerues so thredy that a sufficient quantity of mouing spirits cannot be conuayed through them.

The second, because if they should be moued the hearing would be depraued or vitiated, especially mens eares being small, and therefore Nature hath made recompence by the easie and speedy motions of the Head whereby wee turne on euery side to receiue the sounds; whereas in foure-footed beasts their eares being greater and the motions of their heads not so nimble, they are alwayes moouable to receiue the sounds from euery side, with them also they driue away Flies which men can doe with their hands.

The third reason is because mens eares are short and gristly, so as the muscles and branches of the sinnewes cannot be dilated in them. But such as they are we owe the honour of their inuention to *Fallopianus*. They are of two sortes, Common and proper, and conspicuous enough in those men whose eares we can perceiue to mooue.

The first is common to the eare and to both the lips, and is a small portion of that Muscle which is accounted the first of them which mooue the Cheeks, and the skin of the face called *Quadratus* [*tab. 3. fig. 1.*] or the square Muscle. This sometimes becommeth fleshy and ascending with his Fibres to the roote of the eare [*tab. 3. fig. 1. O*] is inserted vnder the lap, and draweth it downward to this or that side. This Muscle is broad, thinne and foure sided.

The second, which is a proper muscle [*Tab. 3, Fig. 1. neere to B, tab. 4. fig. 1, B B. fig. 2. A*] is seated in the fore-part, and lyeth vpon the temporall muscle, arising from the vpper end and extremity of the muscle of the forehead, where it toucheth with the temporall:

TABVLA IIIII.

FIG. I.



FIG. II.



Table 4. Fig. 1 sheweth the skin of the Head together with the Fat & the glandules under the eares, and the Muscles of the hinder part of the head and the Eares.

Figure 2. sheweth the Muscles of the eares, of the Eye-brows, and a few of the iawes.

BB, The Muscle of the eare springing from the *pericranium* or Scul-skin.

C, The triangular muscle mouing the skinne of the nowle of the head.

The second Figure.

A. The semicircular Muscle of the eare, drawing the outward eare vward, which was noted with B, in the first figure.

BCDEFG. The Muscle as it were diuided into 3. parts, called *Triparsitus*.

H, The hinder part of the outward eare into which the foresaide Muscle is fastned.

NNN, The circumference of the temporall Muscle.

O, The Muscle yet couered with the *Pericranium*.

P, The Membrane couering the said muscle drawne aside.

Q Q Q. The fleshy part of the temporall Muscle.

V, The Muscle *masseter* or grinding Muscle, remooued here from the yoake-bone, whence it hath his originall, that the implantation of the temporal muscle into the proësse of the iaw might appeare.

X, The Muscles making the cheeks.

Z, A Muscle of the lower lip.

aa, The Muscle of the eye-brow.

bb, The vpper eye-lid hauing a Muscle with transuerse Fibres.

cc, The eye-brow hauing a circular Muscle, whereby the externall parts of the eye are exceedingly constringed, as *Placentinus* saith,

this

- His insertion.** this descending toward the eare becommeth narrower, and at his insertion into the vpper part of the eare very tendinous; it is thinne being produced out of the fleshy Membrane, which is but sprinkled with fleshy fibres, as also are the other Muscles of the eares: it is much lesse then the temporall, and from roundnesse becommeth long. His vse is to draw the eare vpward and forward.
- The third.** The third [tab. 3. fig. 1. neere to O] ariseth from the nowle or *Occipitium*, and from the coverings of his Muscles about the Mammillary proceffe or teat-like extuberation, where the Muscles that mooue the head and the shoulder-blade do end. In his beginning hee ariseth narrow but passing downward ouerthwart becomes some-what broader, as if it were diuided into two or three fingers, and is so implanted on the backe side of the eare to draw it backward and something vpward.
- The fourth.** The fourth proceeding from the same Teate-like extuberation or Mammillary proceffe, vnder the Ligament of the gristle of the eare, is of a broad, fleshy and fibrous substance, but in his progresse becommeth narrower till it end in a Tendon, which tendon is fastned into the whole roote of the eares gristle [tab. 4. fig. 2. H] one part of it about another part in the middest, and the third below. And hence it was that *Placentinus* a studious and painfull Anatomist, out of this masse maketh three [tab. 4. fig. 2. B C D E F G] muscles led hereunto by his insertion; all which notwithstanding he saith do arise confusedly out of one place.
- Placentinus his conceit.*

CHAP. XI.

Of the Muscles within the Eares.

The motion
within the eare

BEcause these Muscles are very small, euen the smallest in the whole body, and beside their position depending vpon the curious parts of the eare, we haue described them more at large before in the 19. Chapter of the 8. Booke, wherefore heere we will onely make a little mention of them and trouble you no further in this place. The Hammer and the Anuile haue but a very obscure motion, yet are they mooued, together with that Membrane whereto the Hammer is tyed, vpward and downward by one Muscle within the membrane and another without it. The inner muscle [tab. 5. fig. 2. i] was first described by *Eustachius*, and is seated in the Rock-bone. It is the least in the whole body, so also it is of the most elegant and dainty composition. It ariseth in the basis of the bone called *Sphenoides* or the wedgebone in that place where with the roote of the proceffe of the Rocke bone and an additament of the Nowle-bone, it maketh a broken hole. His beginning is like a Ligament, afterward it becommeth fleshy, and by degrees euen vnto the middest groweth a little broader, after becomming narrower againe, it endeth into exceeding small tendons, [tab. 5. fig. 5. below i] wherof one is infixed in the higher proceffe of the Hammer, and the other vpon his necke. This Muscle draweth the head of the Hammer obliquely forward and inward, leadeth it from the Anuile, and driueth the Membrane outward from the crooked proceffe of the Hammer.

The finalnes &
elegancy of it.

This fift Table is all one with eleuenth Table of the eight Booke.

The second
muscle.

The other Muscle, is seated about the middest in the vpper part of the Hole of Hearing, called *Meatus auditorius*, without the Membrane of the Tympane or Drumme. And about the inuention of this Muscle, two of the best Anatomists of *Padua* in *Italy* doe contend.

The first in-
uenter thereof.

For *Hieronimus Fabricius ab Aquapendente* affirmeth, that he found it in the yeare, 1599. Also *Iulius Casserius Placentinus* saith, that he obserued it first the seauenth day of March, in the yeare 1593. Which of them was the first inuenter I cannot say, but both their diligences deserue great commendations.

The vse both of the former internall, and also of this externall Muscle *Aquapendens* expresseth on this manner.

The vse.

The vse of these Muscles is to preserue the Membrane, which being in danger to be broken or stretched in two places, both within and without; Nature hath provided a defence on eyther side. For on the outside the externall ayre being violently mooued together with the sound, might drine the Membrane inward: and within the Included spirit or the ayre passing from the mouth into the passages of Hearing, might offer violence

vnto

vnto the same membrane by driuing it outward, as in oscitations or yawning gapings, in blowing of the Nose, in retention of the breath, in straying of the Voyce, in emptying the belly, and such like: and therefore the outward Muscle beeing drawne inward together with the membrane by the violence of the ayre, doth with his owne motion retract it outward againe, and contrarywise the inner muscle when the membrane is thrust outward retracteth it backe againe inward: and thus these two muscles keepe the membrane from breaking. And truly it is very necessary that this office of the custody of the membrane should be committed to a muscle & not vnto a ligament: that as the impulsions or motions of the ayre against the membrane be diuers, so the cohibition or restraint and retraction of the membrane toward his owne feate should also be diuers. Now we know that a ligament worketh alwayes after the same tenour or manner, but the muscles as being more voluntary doe worke with a kinde of proportion and measure contracting or relaxing more or lesse as neede requires, and with a diuers motion resisting, yeelding to or amending the impulsions and agitations of the ayre: thus farre *Aquapendens*. He that desires further satisfaction about these muscles let him looke backe to the 19. Chapter of the 8. Booke.

Why these
must needs be
muscles not li-
gaments.

CHAP. XII.

Of the muscles of the Nose.

BEcause the motion of the wings of the Nose is very requisite in sodaine and large inspirations and expirations, therefore Nature hath made them moouable with voluntary motion, for which cause there are certaine muscles inserted into them. For albeit the dilatation & constriction of those wings might be done by the muscles of the lips which also touch them (as also the first muscle of the cheeks which is made of the fleshy membrane [tab. 5. fig. 1. y] and inserted into the roore of the nose) yet we have obserued in them that haue large noses called *Nasuti*, some muscles peculiar vnto the nose it selfe, and these are of two sorts: some seruing for dilatation, others for constriction. I am not ignorant what a medly of opinions there is amongst Anatomists concerning the number vse and scituation of these muscles: but I will content my selfe in this place to follow *Baehnius* only.

Why the no-
strils haue
motion.

The muscles therefore which serue for dilatation of the wings of the nose are foure, two very small ones which arise on either side one from the cheek bone (neare vnto the third muscle of the lips) and the bony canale or pipe which is neare the nostrils. These are more fleshy then sinowy, and proceede ouer the ridge of the Nose and are inserted partly into the outward wing, partly into that part of the vpper lip which they call *Filtrum*.

They are of
two sorts.

Muscles of di-
latation.

The vse of it is to draw that part of the lip together with the wing of the nose outward and vpward whereby it also openeth the nostrils. [tab. 5. fig. 1. F] For as saith *Varolius*, because we smell by a kinde of Traction, together with the wings of the nose the nostrils also doe close and are somewhat obstructed; and therefore in smelling the holes of the nose which we properly call the nostrils are by these dilating muscles opened and so kept.

The vse.

The two other muscles doe arise with a sharpe and fleshy beginning from the suture or seame of the forehead where they are mingled with the ends of the forehead muscles vnto the middle of the distance betweene the eys and the spine of the nose: their forme is almost Triangular, and they descend downward obliquely about the bones of the Nose, where becomming broader they are implanted into the wings, and with their right fibres do draw them vpward and dilate them.

The 2. other
muscles of di-
latation.

There are also foure muscles which doe constringe or contract the Nose, two of which doe arise fleshy about the roots of the wings, but they are very small: these passe overthwart about the wing and imbrace it, and are inserted at the corner of the nostrils. The vse of these is that being contracted to their originall they presse downe the wing, and so shut the Nose, [tab. 5. fig. 2. neere K] The other two are hid within the cavity of the Nose vnder the coate wherewith the hole is compassed: these are very thin and membranous, and doe arise from the extremity or end of the bone of the nose, and are inserted into the wings; which wings by drawing them inward they constringe or streighten, and these muscles as also all the rest in this chapter described are not found in all, but in such onely as haue large noses, as we said before. [tab. 5. fig. 2. vnder K]

The 4. muscles
of contraction

CHAP. XIII.

Of the common muscles of the Cheeks and the Lips.

Four com-
mon muscles.
The square
muscle.



He muscles which are common to the Cheeks and the Lips are foure, two on either side called *Quadratus* and *Buccinator*, the square muscle and the *Trumpeter*. The square muscle [tab. 6. fig. 1. & 2. & 3. & 4. make the circumscription,] for as *Galen* calleth it, the musculous dilatation, or the broad or thin muscle, because it is large and membranous, lyeth vnder the skin of the necke, & also is spread over the lower part of the whole face from vnder the mouth. It is a membrane encreased with fleshy fibres which yet doe not arise from any bone: these fibres do ascend vpward to the middle of the face, ereeping by degrees with a variable course from the regions of the racke-bone of the necke, on the outside of the same where it swelleth most, of the shoulder blades, of the cannell bones and of the brest bones, and so make a broad and thin muscle.

The ancients
before *Galen*
knew it not.
Galen found it

Wherefore if any man shall deny it the name of a muscle, and say it is but a membrane of musculous Nature and substance, or whether he list to call it a muscle, he shall haue my good will, for it is so thin and so membranous that the ancients did not separate it from the skin but fleyed it off therewith; not accounting it in the number of the muscles, as *Galen* saith who himselfe was the first that described it, as appeareth in his fourth booke of Anatomicall administrations, and in his first booke of the dissection of muscles, although hee knew it not when he wrote his Books *de vsu part.* To this membrane many small branches of nerues are sent from the sinewes of the necke and mingle themselves with the fibres; and that is the reason why the membrane in this place is more strongly vnited to the parts then in any place almost of the whole body, and the same disseminatation of the nerues causeth those diuers fibrous passages which are seene in it. For from the breast bone and the middle of the Clauicle or Canell bone his fibres run right in the length of the necke, [from *d* to *e*] and those which beginne from the other parts of the clauicle, from the top of the shoulder, and from the rest of the parts before named, doe bend obliquely vpward, [from *h* to *o* and *H*] and the nearer they are to the spines of the racke bones of the necke the more oblique do they appeare: so that when they come neare the *occipitium* or nowle of the head they are almost transuerse: and yet for all that these fibres make no interseptions in the necke at all, especially that are visible: but when they come vnto the Chin where the vpper lip is ioyned with the neather, [betweene *H* and *z*] especially at the lower lip they are so confounded together that they can bee no more distinguished. We call it the square muscle because it passeth from the vpper part of the necke by the sides of the nowle bone away, toward the eare, & is sometime implanted with fleshy fibres into the root thereof, by the helpe of which

The reason of
the many and
diuers fibres in
it.

Why it is cal-
led the square
muscle.

[Table 6. is the same with the third.]

fibres in those men who haue this position of this muscle, their eares, as we haue said, are moued. Sometime vnder the roote of the eare [*o*] it passeth into the face, and couereth the *Masseter* muscle of the law, and withall groweth more strongly to the Cheeke bone then other where, insomuch as some haue taken this part of it to be the fifth muscle of the Jaw: and from hence it is inserted into the roots of the Nose. The other side of it is ouerthwart the face. [from *o* by *H* to *z*] The third side from the top of the shoulder to the brest bone; [from *h* by *e* to *d*] and this side is very vnequall and is as it were indented. The fourth side to make the quadrature, is from the top of the chinne to the brest bone. [from *z* to *o*.] These muscles doe moue the skinn of the face which is not moued by the musculous substance of the forehead, the nowle, the eares and the nose, or by any of their muscles or by the muscles of the eye lids: But rather as the right square muscle draweth and mooueth both the vpper and the lower lip vnto the right side: so the left drawes both the lips obliquely downeward to the left side: and because they cleaue fast vnto the chinne, therefore they helpe much the opening of the mouth. This is that muscle saith *Galen* in his first booke *de dissect. musculorum*, which first of all in those that begin to be afflicted with convulsions is intended or stretched, from whence come those convulsions which wee call *Cynicke* or *Dogge-spasmes*, because by the contraction of these, men are constrained to writhe and grin like Dogges.

Their vse.

The dogge-
spasme.

The fibres of this muscle *Galen* in his first Booke *de Anatom. Administ.* counselleth the Chyrurgion to be well aduised of, because of their incisions which sometimes are very necessary

cessary in this part. For ignorant Chyrurgions not knowing their course haue by large transuerse sections deuided them so farre that the cheeks haue flown vpward from the skin vnderneath them.

The Muscle called *Buccinator* (either because it maketh the Cheeke which is called *Bucca*, [table 6, figure 2. M] or else because it strutteth in blowing or sounding of the Trumpet which is called *Buccina*, and therefore we call it the Trumpeter) lyeth vnder the former & comprehendeth al that part which is blowne vp when we sound a Trumpet. It is round and ariseth almost from the whole length of the vpper law, and is inserted into the length likewise of the lower law at the roots of the Gummes; or if you list to thinke with *Columbus* & *Laurentius* it ariseth from the top of the Gummes, and like a circle doth againe determine into the top of the Gummes. For it being like a circle wherein the beginning, the middle and the end are all one, it skilles not much whether you say it proceedeth from below vpwards, or from aboue downewards.

Thin it is and membranous wouen with many fibres, from whence come the variety of the motions which it performeth, within and without, aboue and below. To this Muscle on the inside, the coate which compasseth the mouth groweth so fast that they cannot bee disseuered but one of them must be broken.

The vse of this Muscle is whilest the law resteth, to moue the Cheeks and the Lips, and yet euen in eating when the meate is fallen into the cheeks, it serueth as a hand to reach it againe vnto the teeth and to driue it hither & thither amongst them, that the aliment might be better broken and shred, and so prepared to be boyled into Chylus in the Stomacke.

Besides these there is a double vse of the cheeks and of their cauities as *Archangelus* hath well obserued. The first, that if any thing in eating doe fall from the teeth outward it should not be lost but be kept within the Cheeks: the other vse is that they might be places of receite to contayne the meate while the teeth be ready for it; as we see in Apes which fill the pusses of their cheeks with meate which afterward they chew. Moreouer, in man they help much for pronounciation and in winding of a Horne or Cornet and sounding of a Trumpet; for if these cheeks be puffed vp a man may obserue the diuers motions of this Muscle by rowling his mouth outward, vpward, downeward, forward and backward.

CHAP. XIII.

Of the proper Muscles of the Lips.

The vse of the Lips in all creatures is for Eating and Drinking, and therefore Nature hath provided their Lips according to their Dyet. The Assie can mumble a Thistle as well as a Man can cate Lettice, whence the prouerbe is, *Similes habent Labra Lactucas*, Like Lettice like Lips. But because there is another vse of the Lips in men, for forming of words, for casting forth of spittle and to preserue the Teeth from the coldnes of the aire (that I speake not of the ornament which they are to the mouth yea to the whole face) for these reasons I say, it was necessary that the Lips should haue voluntary motion, and so the instruments of the same, that is, muscles.

Many of the Ancients and late writers also thought that both Lips were moued by the helpe of the broad Muscle before spoken off, because the great variety of his fibres they thought sufficient for the accomplishment of al necessary motions in that part. But the more diligent Anatomists, beside those aboue named common to the Lips and the Cheeks haue found out other proper muscles belonging to the Lippes alone, about the number whereof they doe not agree. We for this time will conclude that they are fixe, on each side two belonging to the vpper Lip, and on each side one belonging to the neather.

The 1. paire of the vpper Lip [tab. 6. fig. 1. GH] ariseth from the vtter seame of the Iugal or yoke-bone, and that which separateth the first bone of the vpper law from the third and from the cheek-bone. In their beginning they are broad and fleshy, and descend obliquely forward, inserting themselues into the sides of the vpper Lips, which they moue vpward & downward, inward and outward: and that by reason of their diuers fibres diuersly commixed among themselues and wouen with the skin: from which notwithstanding if the body be musculous or fleshy & not fat & the workman diligent, it may be after a sort separated.

The second paire [tab. 6. fig. 1. vnder H] arising fleshy, round and couered with much fat,

T t t

from

The trumpeter

His site.

His originall.

His insertion.

The substance of it.

The vse.

A double vse of the cheekes out of *Archangelus*

The proper vse of the lips in men.

The opinion of the ancients.

6. proper muscles of the lips.

The 1. paire.

The second paire of muscles.

TABVLA VII.

FIG. III.



FIG. IIII.



G, The lower Glandules at the Larynx. H, The muscles of the head and the necke mingled. I, The tongue with the Epiglottis or ouer-tongue. K, The rough artery bared from the muscles. L, The bed of vessels neere the Larynx, and the first muscle of the backe. N O, the fift muscle of the lower iaw called *Digastricus* hanging from his originall. X, the 4. muscle of the shoulder blade arising from the necke.

from the cavity vnder the cheeks; is inserted into the bridle where the Lips do meet, and they say it turneth the vpper Lip downward.

The lower lip hath one paire [tab. 4. fig. 2. Z, and tab. 6. fig. 2. N] which ariseth fleshy from the lower part of the vpper iaw, where there is a kinde of asperity or roughnesse at the sides of the chin: thence bending obliquely vpward and becoming broad (for it is broader and shorter then the former paire) are implanted into the middle of the lips, with whose skin as the former they are so mingled, that the Fibres do in a kinde of finger-fould cut betwixt one another.

Their vse.

Eight feuerall motions by these muscles.

By the helpe of these Fibres the motions of the lips become very Diuers, so that *Galen* writeth in his 11. Booke de vsu part. and the second de Dissectionibus Muscularum, that by these muscles (which yet he would haue to be foure) there are 8. feuerall motions effected, foure oblique, two in each lip: and beside them foure other right, two altogether right, eyther when the lips are furthest asunder, the one yeelding vpward to the nose, the other downward to the chin: or when the lips are close ioyned, the vpper being drawne downward, and the lower vpward.

For as in the wrest of the arme right motions are made by the confluence or concurrence of oblique motions, so is it also in the lips: for if the muscle of either side do alone worke, that motion is made side-long, but if both of them be at once stretched, then shall the same lip be after one and the same manner drawne vpward by the vpper muscles and downward by the lower. Thus *Galen* exemplifieth the vse of these muscles in the places last aboue named, to which he that desires more satisfaction may haue recourse, wee will follow our story.

The Corral of the Lippes.

The Vse of the Corral.

To these muscles before described that fleshy and rude lumpe [tab. 7. fig. 3. C] and yet musculous may be added, which in the circumference of the mouth maketh the lips both aboue and below, which by some is made a peculiar paire of muscles of the face: we call it (if you please) the Corral of the lip. *Falopius* diuideth them into two muscles, whereof one garnisheth the vpper lip, the other the lower: and he ascribeth to them as to other muscles their feuerall motions, gathering and wrinkling themselves vp, and with them the flesh of the lips when we would make our mouths little.

Table 7. figure 3. Sheweth some muscles of the iaw, the Larynx and the bone Hyois.

Figure 4. Sheweth some parts lying in the month.

A, A hole in the forehead bone, sending a small Nerue into the brim of the seate of the eye

B, the temporall Muscle.

C, A fungous substance of the lip, together with the nerues stretched on both sides vnto it. (face.

E, A hole in the cheek blending a nerue vnto the

G, A part of the yoke bone here taken away.

I, The *Masseter* or grinding Muscle.

K, A portion of the 7. muscle of the head cut away.

L, The bone *Hyois* bared from the muscles.

M, The *Buccinator* or Trumpeter.

m, The 6. muscle of the bone *hyois* according to *Falopius*.

O P, The double bellied muscle of the iaw.

Q, The 2. of the common muscles of the Larynx.

R, The first of the common muscles of the head.

S, A portion of the second muscle of the head.

VV, 2 Venters or bellies of the 4. muscle of the *hyois*.

X, The 4. *Leuator* or beauer of the shoulder-blade.

Y, the first muscle of the chest vnder the coller bone.

Fig. 4. A, a portion of the Temporall muscle.

B, a sharpe proesse of the lower iaw into which the temporall muscle is inserted. * The palat.

C, The left part of the lower iaw.

D, the 4. muscle of the lower iaw lying in the mouth.

E, The *Gargareon* or *Vuula*.

F, the vpper Glandules at the *Vuula*.

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CHAP. XV.

Of the Muscles of the lower Jaw.

OF the two Iawes, the vpper as wel in man as in al other creatures is immooue-
able excepting the Parrot & the crocodile, the lower is necessarily mooued for
the breaking and preparing of our meate, and the articulation of the voyce. The
motions of this lower iaw are of two kinds, simple and compound, the simple
motions are fixe, and the compound but one. The fixe simple motions are vpward and
downeward, to the right hand and to the left, foreward and backward. The compound
motion is made of the right and the left, the forward and the backward, whereby the
iawes seemeth to be carryed round. The motion vpward is performed by the temporal
muscle, downeward by the Diagastricke; to the right hand and to the left by the first grin-
der called *Mansorius primus*: backward by the other *mansorius* or the muscle that lurketh
in the mouth: forward by the fifth paire.

The motion vpward and downward is to bite, or to share or cut: the motion to the sides
whether it be to the right hand or to the left, foreward or backward is to grind: for the
meate falleth vpon the teeth of the lower iaw, as vpon the moouing stone of a Mill. For as
in a Mill the weight of the vpper stone breaketh the corne vpon the lower: so the meate is
ground betweene the vpper teeth which resemble the fixed or immooueable stone of the
Mill, and the lower teeth set in the lower iaw which resemble the moueable stone. And
therefore these Muscles are called *Molares*, that is, the grinders, & because their act is called
Mastication or chewing, therefore they are called *Masticatorij* or *Mansorij*, that is, the
chewers. Wherefore the Mouth is opened, shut, drawne in compasse by five muscles on
either side. The first is called *Temporalis*, *Galen de dissect. musculorum* 6. ca. it *Crosophita* [tab.
6. fig. 1, and 2, B: tab. 4. fig. 2, his circumference is noted by N N N, his fleshy part by Q Q Q, conered
yet with the pericranium at O and the Membrane retracted or drawne backe at P] we call it the
Temple or temporal Muscle because it is seated in the temples that is in the side of the head
at the vpper and forepart of the Eare. This muscle is strong and stiffe, and the largest of
all the rest; filling all the cavity of the temple bones. It ariseth [tab. 6. fig. 2, a b γ] with a
broad fleshy and semicircular beginning or originall from the first bone of the vpper iaw,
of the forehead, of the forepart of the scull, of the temples and the *Sphenoides* or wedge
bone, and becomes by degrees more fleshy, and growes narrow vnder the yoke bone called
Jugale which runneth vpon it & about it ouerthwart [tab. 6. fig. 2. 6] & to which it groweth
a litle for better defence, and is inserted with a short nervous and exceeding strong Tendon
to the sharpe [tab. 7. fig. 4. b] proceffe of the lower iaw imbracing it very firmly with his
large armes.

The strength of this muscle (by which sometimes a man is able to bite a strong naile in
sunder, and we haue known a man therewith to guide a great bell being rung to the height)
is caused by his fibres: for al of them as it were from 3. parts of a circle run vnto his center,
which is to be obserued in the dilatation of the wounds of this part & must sometimes neces-
sarily be made, as also because of the apostemations of these Muscles that the Chyrurgion
may know how to make incision according to the rectitude of his fibres, lest if hee wound
them ouerthwart, their vse and action should perish, and the life saith *Columbus* with it.

The vse of this Muscle together with his fellow is, if they draw directly vpward to lift vp
the lower iaw, to bind it strongly and to shut the mouth. But if one of them draw alone, then
is the traction of the iaw oblique, although *Vesalius* thinketh that this oblique traction is
made by 3. muscles, the temple muscle, the *masseter* or chewer and that that lies hid in the
mouth; whence it is that some make three *masseters*, but *Hippocrates* in his *Booke De Arte*,
mentioned but two. This Muscle the Ancients and amongst them *Hippocrates* and *Galen*
haue preferred before many others & admired in his composition the wisdom and prou-
idence of the Creator in making it diuersly according to the diuers vse of the creature.

Galen also in his 11. Booke of the vse of parts and the third Chapter, sheweth how these
muscles if they be wounded do especially bring convulsions, feauers, deepe and dangerous
slecpines, and light frenzies. And *Hippocrates* saith, that the wounds of the temples are
mortall. The reason of these accidents may be because they are neare neighbours vnto the
braine, there being onely the scull betweene, and that parted by the coronall suture or
crowne seame: as also because of the many & large Nerves which are disseminated through

Onely the Pa-
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Crocodile
moueth the
vpper iaw.
Sixe simple
motions and
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The vse of
these motions.

Five muscles.

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iaw.

Hippocrates.

it as *Galen* hath obserued in the former Booke and the 7. Chap. Ad hereto that this muscle hath 3. nerues on either side inserted into him: two from the third coniugation, and the third harder from the first coniugation to giue him the greater strength, for the more nerues and the harder a muscle hath, the stronger it is to performe his action. No maruell therefore if vpon the wounding or concussion, convulsion yea death it selfe doe follow.

The dangers
of the falling
of the iaw.

How nature
hath defended
these muscles.

And hence it is that *Hippocrac.* thought the luxation of the neather law was oftentimes deadly, because thereby this Muscle is distended, and in his Booke *de articulis* he saith, that vnlesse the bones of the neather law be ioyned againe after their luxation the life will be in great ieopardy, by reason of the continuall Feuers and dull and drowsie sleepeinesse which follow thereupon: for these muscles if they be altered from their naturall disposition, and intended or streatched are *soporiferous*: Wherefore Nature for their better defence hath couered them first with a strong, thicke and hard membrane, which is the *Pericranium* or scull-skinne, by reason whereof the muscle on the outside looketh liuid, for his inner part which cleaueth to the bone is altogether fleshy, because the bone in that place is not couered with *Periostion*. And because a part of the *Pericranium* runneth ouer this Muscle, some haue described it with two tendons, one inward and another outward.

The second
defence.

Another defence it hath is this; that the lower part which is neruous is walled with the Iugall or yoake-bone, that the nerues (saith *Galen* in the 8. Chap. of his 9. Booke *de usu partium*) should not be hurt, so as this bone seemeth to haue beene made only for the behoofe of this muscle.

The third.

In what crea-
tures these
muscles are
greatest.

In what crea-
tures least.

Thirdly, the Tendon of this Muscle is defended aboue and below with flesh that it might be better secured from outward iniuries. The difference of these Muscles according to the variety of creatures is after this manner: First of all in men they are the least and least neruous ordinarily; among beasts they are the least in Apes, I meane according to their proportion. They are greatest and largest, as also most neruous in such beasts as haue their teeth set like a Saw, as Lions, Wolues, Dogges and such like. There are other creatures wherein they are very large but not so neruous; large not so much for the strength of the action, because those great creatures doe feede most what vpon the earth, but that they might be proportionable to the magnitude of the lower law; such are Asses, Horses, Oxen, Cammels and such like, as we may reade at large in *Galen* 11. Booke *de usu partium* and the second Chapter.

Why least in
men.

They are least in men both because our neather law in respect of other creatures is the very least, and beside, because our teeth are giuen vs only to breake our meate and for no other vse: for a mans fortitude consisteth not in the strength of his lawes, neither doth he thereby curbe and keepe in awe the other creatures but by reason and by his hands. Notwithstanding they are the greatest of all the muscles of the law, because they almost sustaine it and lift it vp as if it hung and depended onely vpon them.

The 2. mus-
cle of the lo-
wer iaw called
the grinders.

The second Muscle of the lower law is called *Masserius primus*, *Masseter & molitor*, names all taken from the vse of the Muscle which is called *Manducation* or chewing, & therefore we may well call it in our English the Chewing or the grinding muscle. His position is in the cheek [tab. 6. fig. 2. & tab. 7. fig. 3. 1. tab. 4. fig. 2. V] & it hath a double head, one neruous proceeding from the ball of the cheek [tab. 6. fig. 2. A] vnto the suture where the law-bone meeteth with a part of the Iugall or yoake-bone, and passeth along vnto the vtmost angle of the law which we call his acute or sharpe proesse; the other head is fleshy and passeth from the yoake-bone [tab. 6. fig. 2. x & tab. 7. fig. 3. at G] toward the chin, and is implanted very strongly [tab. 6. fig. 2. u] with a broad insertion to the whole latitude of the lower law, so as it representeth, saith *Galen* in the 4. Chap. of his 11. Booke *de usu part.* the corner of a blunt or obtuse triangle, the top whereof is neare the ball of the cheek, [A] one side toward the end of the yoake-bone [from A to x] another side toward the lower law [from x to u], and the third and last as it were a Basis ioyneth both the forenamed sides to all the parts of the lower law, being extended or streatched according to his length.

His fibres.

The Fibres of these heads do intersect themselves like this figure x, and thence it is that they moue the law as well on both sides as also forward and backward (for there is a diuers motion required in chewing or grinding the meate) and in compasse: for as the vse and action of the temporall muscles was vehemently to ioine the teeth and the two lawes together, and so to breake whatsoeuer should light between them: so the action of these chewing or grinding muscles is to leuigate or shred small the meate that is before broken by the temporall muscles. To this action the tongue doth not a little helpe, which like a

hand

hand turneth and returneth the meate in the mouth that all his parts may come vnder the Breake; which motion of the tongue is performed by a muscle of the Tongue called *Linguae Masticator* or the Tongues Chewer, and not onely so, but also the muscles of the cheeks are of great vse toward the performance of the foresaid worke.

The third payre of muscles [tab. 7. fig. 4. neere to B] is situate vnder the temporall muscle in the lower part of the cavity of the Temple bones, and taketh his beginning partly from the vpper & vtter parts of the processes called *Aliformes* or like vnto wings which are sharp and vnequall; and partly from the rooffe and sharpe top or height of the bone called *Sphenoides* or the wedg-bone, which in the cavity of the temples looketh directly against the yoke-bone, where it hangeth ouer a large rift made by the same *Sphenoides* and the greatest cheeke bone.

The 3. paire of muscles of the lower iaw

The original or head of this muscle is partly neruous and partly fleshy, and having gotten this fleshinesse it is led obliquely backward and is inserted into the necke of the lower iaw, and into the inside of his head. His vse is to mooue and lift forward the Iaw, as the next that followeth mooueth it backward.

The fourth muscle is another *Manforius* which *Galen* in his fourth Booke of Anatomicall administrations the fourth Chap. and diuers other places, calleth the muscle lurking in the mouth, [tab. 7. fig. 4. O] because it lyeth hid in the great bosome of the inside of the Iaw. This muscle is thicke and short, and ariseth very neruous from the inward cavity or hollow pipe of the wingy processes of the wedge-bone called *Sphenoides*; afterward becomming fleshy, large & thicke, it descendeth with right fibres, and is inserted with a strong neruous and broad tendon to the inner and backe-part of the lower Iaw where the roughnes is, and where the bosome or hollownes is fashioned that it might not take vp too much roome about the Almonds of the throate. And this muscle (saith *Galen*) helpeth the temporall muscle to which it groweth strongly neere the production and insertion of this tendon; for it draweth the Iaw inward and vpward, and shutteth the mouth, because it is a matter of labour to draw a heauy thing vpward, and to breake and grinde a hard substance: besides when the Iaw is brought forward it draweth it backward againe. The fift Muscle called *Graphioides* or *Digastricus*, double bellied [tab. 7. fig. 3. O P, and fig. 3. N O, tab. 6. fig. 2. O] is thin and small; arising membranous and very broad from the Appendix called *Styloides* (*Galen* called it *Graphioides*) because the Ancients vsed to write vpon waxen Tables with a Probe which they called *Stylus*; and immediately becommeth fleshy and round and passeth vnder the lower part of the vpper Iaw and the eare, & in the middest where it is curued or crooked at the turning of the lower iaw it loseth his flesh and becommeth Neruous: and againe recovering his flesh is inserted into the middle of the iaw fast by the lower part of the chinne, where the inner bone becommeth a little rugged for his better insertion, and where both the Muscles of each side do meete; albeit about his middest it cleaueth to the bone called *Hyoides*. There is also in this place a kinde of forme of a Pulley; for because these Muscles do not arise from the lower parts of the necke but rather from the vpper, they could not mooue the Iaw downward vnlesse they had beene wound about the lower angle of the lower Iaw, as it were about a Pulley.

The 4. muscle of the lower Iaw.

The fift and last muscle of the lower iaw, His variable substance.

The vse of this paire of Muscles is to draw the Iaw downward, and so to open the mouth and by consequence to draw the tongue toward the throate: but if one of them onely do mooue, it leaderth the Iaw obliquely to his owne side. It was called *Digastricus* because it hath two Venters or Bellies, being fleshy in the beginning and in the end, and in the middle [tab. 7. fig. 3. betweene O and P fig. 4. betweene N, and O] neruous or tendinous (which is peculiar to this and to the second paire of muscles of the bone *Hyoides* [tab. 7. fig. 3. V, V] and to the fift proper paire of the Larinx or throttle) partly for more strength, partly that it might not take vp too much roome because the place is but narrow, and there are many Instruments to fill it vp, especially the muscles of the tongue and of the *Hyois*: and therefore also they were made small and thin, round and long, their motion beeing but easie: for the iaw fals downward with his owne weight, and therefore needed no strong retractor.

The vse of these muscles together.

What muscles haue 2. bellies

Finally, because a part of the square muscle (which with *Galen* we reckoned among the muscles of the cheeks) groweth more strongly to the bone of the lower Iaw, the right and the left meeting at the middle of the chin to draw the same downward; therefore *Arantius* (who did not acknowledge the third paire aboue named) maketh it the fift paire of the Iaw, and saith, that this portion or part of the square muscle together with the fourth paire called the *Digastricks*, do open the mouth and draw the Iaw downwards, yet so that it is

The reason of Arantius his opinion.

The vse that Arantius misteeth

more directly drawne (without the motion of the cheeks) by the fourth paire; but by this fift paire as he accounteth them, the iaw is wrested obliquely together with the cheeks and the lower lip side-ward if but one of them moue; if they moue together, then it inclineth it to neither part but leadeth it toward the throttle.

CHAP. XVI.

Of the Muscles of the Chops which serue for Diglutition or Swallowing.



Alen first of all men described the muscles of the Chops, whome after *Oribasius* his *Epitomizer* and *Auicenna* followed, making one on each side. Among the later Anatomists *Falopius* was the first who described three paires; which are seated in the Mouth betweene the coat of the palate and the bredth of the Nostrils.

4. paire of muscles of the chops.

We will reckon vnto you 4. paire, whereof two doe dilate and two contract; and therefore they helpe the Swallow because the Chops were of necessity to bee dilated or straightned when the meate and the drinke should passe by them.

The first.

The first paire ariseth thin and neruous from the top of the wedge-bone called *sphenoides* neare the articulation of the lower iaw with the bone of the temple, and descendeth very small and slender by the inward cavity of the *Pterygoides*, and endeth in a neruous thin and broad tendon which passeth over the cleft which is in the end of the *Pterygoides*, and being reflected is inserted into the skinny part of the palate at which the *Vuula* hangeth. If both these muscles moue together they draw the bottom of the chops, together with the *Vuula* vpward and forward; if but one of them moue, then it draweth vnto that side where-in it is seated.

The second.

The second paire ariseth neruous from the same beginning with the former, and declining downewards it is inserted into the sides of the chops where the Tonfils or Almonds doe reside, and taketh vp or at least embraceth all the side and backpart of the Chops. This paire draweth the Tonfils vpward and sidelong, and dilateth the whole cavity of the chops by parting them asunder. These two paires serue to dilate or open the Chops, and some say they hinder the liquid matter that comes vp in vomiting that it passeth not through or into the nose.

The third.

The third paire compasseth the backward and side cavity of the Chops, and ariseth very thin where the head is ioyned with the necke, whence it descendeth and is inserted in the sides of the bone *Hyois* and the first gristle of the Throttle, sometimes also into the roote of the Tongue but obscurely & it constringeth the Chops when a man swalloweth; and as *Falopius* perswades himselfe it helpeth to swallow a great morsell; because in diglutition or swallowing of meat it raiseth vp the throttle.

The fourth.

The fourth paire ariseth very slender from the inside of the appendix called *Sigloides*, declineth forward, & is inserted with a membranous Tendon to the first Gristle of the *Larynx* or Throttle, to the sides of the bone *Hyois*, and the extremity of the rootes of the Tongue: and therefore (saith *Platerius*) it may be said to be a paire common to the chops and to the Tongue, because it draweth the tongue and the foresaide parts backwards and vpward, and constringeth the chops as we swallow. These two latter paire doe contract the chops and somewhat lift vp the throttle that the swallow might be the more facile and easie.

CHAP. XVII.

Of the Muscles of the Bone called *Hyois*.

BEcause the meate when it is broken by both the Iaws and their Teeth, by the helpe of the Muscles of the Cheeks, the lower Iaw and the Tongue, must be swallowed and transmitted into the Stomacke; and that this diglutition or swallowing is a voluntary motion, it had neede of Muscles appropriated thereunto and distinct from the muscles of the tongue, because we can swallow and yet hould our tongues still and stedfast: and beside, the muscles of the Tongue doe accomplish other priuate motions of their own.

These Muscles which serue for diglutition they make to be proper to the bone *Hyois*, both because they are annexed vnto it, and do also moue it vpward and downeward, and to both sides; for the bone it selfe was necessarily to be moouable, because it was ordained

to be helpfull to deglutition. But there are two kinds of muscles which are ioyned to this bone: some haue their originall from it but do serue other parts, as the tongue and the Larynx. Others that take their originall from other bones, and yet are inserted into this *Hyois* and are proper to it, and of these we will intreate at this time, reckoning vp vnto you 4. paire although there be some who account fixe.

Four pair of Muscles.

Of these two paire are numbred with the muscles of the tongue, because the motions of the tongue and of the bone *Hyois* are very neare akin, and therefore it is no wonder if their muscles be mixed and connected together.

The first paire run betweene the brest bone and the bone *Hyois*, and are therefore called *Sternohyoidei* [tab. 6. fig. 2. Q R] and appeare outwardly vnder the skin lying vpon the sharp artery and the gristle of the throtle called *Thyroides*. It ariseth with a broad and fleshy beginning from the vpper and inner side of the brest-bone, and runnes directly vpward, and is implanted very fleshy without a tendon (saith *Columbus*) into the foreside of the basis of the bone *Hyois*. All along their passage they are fleshy and broad, and are diuided in the middest by a line which passeth according to their length. Their vse is to draw the bone straight downward and backward, and by accident also they defend the throtle and the gristle *Thyroides*.

The 1. paire

The second paire called *Genio-hyoidei* [tab. 6. fig. 2. S] are vnder the chin, and the left paire of the lower iaw. [tab. 6. fig. 2. O] They are large and short and fleshy all ouer, and do arise with Fibres of a diuers course from the inner part of the lower iaw, and are inserted with the same breadth into the middle part of the bone *Hyois*, into which also the first payre was implanted. They draw directly vpward and somewhat forward.

The 2. paire

The third paire called *Styloceratocidei* [tab. 7. fig. 2. T] is seated obliquely and vnder the Chinne as the former, and are outwardly stretched vpon the fift paire of the neather iaw. They are slender and round, and arise from the roote of the Appendixe *Styloides* about the originall of the fift muscle of the iaw, and end into the hornes of the *Hyois*, that is, into the laterall or side parts thereof, and they are sometimes perforated in the middest to giue way to the muscle which openeth the iaw. They moue the bone toward the sides and somewhat vpward.

The 3. paire

The fourth paire is called *Coracohyoidei*. [tab. 6. fig. 2. VV. tab. 7. fig. 3. VV] They lye lurking vnder the fourth muscle of the shoulder-blade, as *Vesalius* & *Platerus* haue noted. They are slender and long, and do arise out of the proesse called *Carocoracius* at the vpper end of the shoulder-blade nere his necke, and do run obliquely vpward vnder the 7. muscle of the head, and are implanted where the third paire is, into the beginning of the lower proesse of the bone *Hyois*, and these draw downward vnto the sides. This is along paire, on eyther side fleshy and hath a double belly, and therefore *Galen* cald them *Digastricks*, but in the middle they are slender and neruous as is the fourth muscle of the iaw and the fift proper muscle of the Larynx, and extenuated into the forme almost of a Tendon, haply to giue way to the 7. muscle of the head (which heere runneth ouer him [K]) as to his better.

The 4. paire

Concerning the vse of these muscles, we craue leaue to add yet a little more: some thinke they were not ordained for motion but rather for tension, to tye, establish and suspend the bone *Hyois*, so saith *Laurentius*: others as *Archangelus* thinke, they serue for deglutition, and that they are the proper muscles of the *Hyois*. Others as *Arantius*, because this bone is the basis of the Tongue, and because the basis of any thing can by no meanes bee mooued, but that also must be mooued which is established vpon that basis, do thence determine that these muscles do mooue the Tongue, and so much the rather because the manifold and frequent motions of the Tongue can hardly be imagined to be accomplished by so few and so small muscles as determine or end in the substance of the Tongue. Wherefore these may be called the common Muscles of the tongue and the *Hyois*, into which certaine Nerues are distributed from the sixth Coniugation.

An addition concerning the Vse of these muscles. *Laurentius*. *Archangelus*. *Arantius*.

CHAP. XVIII.

Of the Muscles of the Tongue.

THE Tongue hath three ends in Nature; to speake, to taste, and to rowle the meate in the mouth, which cannot bee performed without motion, and therefore Nature hath

hath allotted vnto it Muscles, which from those three actions may be called, the *Talkers*, the *Tasters*, and the *Rowlers* of meate. In man the especiall end of the creation of the tongue and of the motion of the same is for speech, as in beasts for tast.

The especiall
vse in man.

For because they want hands wherewith to reach their meate or fother vnto their tast, it was necessary they should be able with their tongues to licke and gather it of the earth: but man is able to tast without the motion of the tongue, because he hath hands wherewith to bring that he would tast vnto the instrument or organ of the sense: but both of them haue necessary vse of it in rowling and returning the meate againe vnto the teeth which falleth from them into the space of the mouth.

The bridle of
the tongue.

Wherefore that it might answer those intentions, it was made moueable and had therefore muscles, and not muscles onely, but also a figure fit for motion, some parts being thinner then other: yet because it should not moue beyond his teather, Nature hath restrained it with a ligament, that the body of it which by reason of the diuers fibres it had was infinitely disposed to motion and agitation, might rowle vpon that axletree, or turne vpon those hinges onely: but of these things we haue spoken sufficiently heretofore, excepting of the muscles whose proper place this is.

Muscles of the
tong double.

The Muscles therefore of the Tongue are double, some are common, others proper. Those are esteemed to be common, which haue already bene said to belong to the bone *Hyois*, vnto which the third paire also now to be mentioned may happily be referred: and those proper which hauing their originall other where, do determine and end in the substance of the Tongue.

The 1. paire.

The first paire are called *Styloglossi* or the Auger-tongue Muscles [tab. 8. fig. 1. and 2. F] *Galen dissect. muscul.* 14. calleth them *στυλογλωττι*, that is transuerse. They haue slender originals from the vtter face of the Appendix *Styloides* (as the fourth paire of the throat from the inside of it) and are implanted with transuerse fibres into both sides of the Tongue about the middle thereof, yea they proceede forward and attaine vnto the top of the Tongue; & when the Tongue is lilled out they draw it in againe. But because their Fibres are so wouen one within another, when both of them are at once contracted toward their originall they lift the tongue directly vpward, but when one of them onely worketh then is the tongue lead vpward to one side onely.

[Tab. 8. is the same with that in lib. 8. Tab. 14.]

The 2. paire.

The second paire are called *Myloglossi* or the grinder-tongue Muscles [tab. 8. fig. 1. and 2. G] They arise with broad and inuerted originall and transuerse fibres from the sides of the lower iaw neare the roots of the grinding teeth called *molars*; and are inserted on both sides into the length of the ligament which is vnder the basis or foundation of the tongue, and degenerateth into the bridle by which the tongue is tyed to the Chops. When one of these works we turne the tongue vpward and obliquely, but when both of them moue, then the tip is directly lifted vpward to the palate and vpper teeth. Sometimes this paire doubleth the tongue or maketh it hollow like a gutter, and sustaineth it so in forme of a compassed bow to the palate with the assistance of the ligament and bridle becoming somewhat rigide or stiffe. And if the second paire belonging to the bone *Hyois* doe worke with them, then the tongue becommeth more narrow and solid and is exerted or thrust forth to his extent beyond the lips.

The 3. paire.

The third paire are called *Genuaglossi* or the chin-tongue Muscles. [table 8. fig. 1. and 2. H] They arise with a narrow beginning from an asperity or roughnes in the inside of the middest of the Chin; afterward they become broader and replenished with right fibres, and are implanted into the middle of the tongue the greatest part of them at the roote, yet some part of them runs out toward the tip, so that the diuers parts of the same Muscle do worke contrarily. For the greatest part of their fibres beeing drawne toward their originall thrust the tongue beyond the teeth and the lips, (although *Auerrhoes* thought that a proper motion of the tongue) the lesser part in their action draw it againe inward. Sometimes they communicate some fibres to the bone *Hyois* which they so draw vnto the chinne. They haue also certaine lines in them which Anatomists call *inscriptions* as if they were many Muscles.

Their contra-
rie vses.

The 4. paire.

The fourth paire are called *Basiglossi* or *xyfiglossi* or bone-tongue Muscles. [tab. 8. figure 1. & 2. D O] These doe arise straight fleshy from the vpper and middle part of the bone *Hyois* and in some places are obscurely diuided asunder, as if they were many muscles, & so run along the length of the tongue, and are inserted in the middest of it. Their vse is when they

they are contracted to draw the tongue directly inward or backward toward his root.

The fifth paire are called *Ceratoglossi* or *horne-tongue* Muscles [*tab. 8. fig. 1. and 2. E*] and arise from the vpper hornes (if they be there) of the bone *Hyois*, from whence passing somewhat obliquely or sloping they are inserted into the sides of the tongue neare vnto his root; sometimes they arise from the neather hornes when the vpper are wanting, or are not very bony, but rather like ligaments, which as we haue sayd is most commonly in women which haply makes their tongues more plyable. If one of these onely be contracted the tongue, especially the roote of it, is drawne side-long downward, and so it may be sayd to mooue to the right side or to the left: but if both of them be contracted then is it mooued right downward toward the throate; this paire in Oxen is double, in men it is but single.

The 5. paire.

Why women's
tongues are
gib.

These five paire of Muscles therefore do mooue the tongue vpperward, downward, forward, backward, on the right hand and on the left hand, or to the sides, but if they worke successiuelly, that is, one vpon another, then they turne the tongue round; and all these motions the muscles of the bone *Hyois* do not a little further, which some do rather ascribe to the fibrous substance of the Tongue, which hath indeed all three kinds of fibres.

The substance
of the Tong.

At the root of the Tongue when these Muscles are remooued there appeareth a certaine flesh compounded of many Glandules mingled with fat, which flesh doeth not merite the name of a muscle, because a Muscle doeth not consist of glandules or kernels but of fleshy fibres. [*tab. 8. 1. and 2. H*] This knot of glandules groweth at the roote of the Tongue that with their liquor it might alwayes be kept moyste, because without moysture there can be no perfect taste, no more then there can be any concoction in the Stomack without Elixation or boyling, for the concoction of the Stomacke is not a roasting but a boyling or elixation; and therefore Nature hath ordained the Glandulous *Pancreas* or Sweet-bread to touch the Stomack, that thence there might continually ascend moyst vapors that the concoction of the stomacke might be accomplished by a moyste boyling, not by a dry roasting.

The glandu-
lous flesh at
the roote.

Moreouer, this moysture of the kernelly flesh maketh the motion of the Tongue more glib and glad as we say, or nimble; for when the Tongue is dry (as we may perceiue in those that are exceedingly a thirst) his motions are more flow, the same also we haue experience of in those that labour of burning Agues, in whome all the moysture of the Tongue is exhausted and dried vp. Moreouer, the Almonds of the Throate which we call *Tonsille*, as is before obserued by yeilding a perpetual moysture, doe moysten the Tongue and so further his motion.

CHAP. XIX.

Of the Muscles of the Larynx or Throate.

BEcause the actions of the Throate or *Larynx* are performed with a voluntary motion, Nature hath giuen it muscles, which by their action which is Contraction might bend, extend & mooue sidelong the ioynts of the gristles, that so the *glottis* or Young-let might become mouable and his cleft might be made broader or narrower as need should require: for so it behoued to be, because it was conuenient that our voice as well as our speach should be at our command. The Throate therefore hath two kinds of Muscles, Common and Proper. The Common are fixe, (or three paire) of which foure doe constringe and two do dilate it. The Common are so called because they arise from other parts, and are but implanted into the Throate; and of these we will treat first, because they first fall vnder our view and so come first to be shewen.

The action of
a muscle is
Contraction.

3. paire of
common.

The first paire of the common Muscles [*tab. 9. fig. 6. 20.*] which *Vesalius* and diuers others do make the second, is situated in the fore part of the Throate, one on each side, & we call them *Bronchios* or the weazon Muscles, because they cleaue to the rough artery al along, which is called *Arteria* by *Hippocrates*. For they arise with a fleshy and broad beginning from the vpper and inner part of the Breast-bone at the very *Inguinum* about the clauicles, and with right fibres doe runne vp along the weazon fleshy and a little broader then where they arose, & are inserted into the sides of the shield-gristle called *Thyrois*, below neare the Glandules with a broad and fleshy Tendon, which in man is but one, but in beasts it is deuided in the middest, and in most of them one part is fastned into the throate, the other into the bone *Hyois*. Yet *Galen* is of opinion that this is their originall, and that they are inserted into the breast-bone.

The first
paire.

They

They are very long, because not the shield-gristle or the *Thyroides* onely, but the whole *Larynx* is moved especially in a base voice, where the throttle mooueth downeward, and the whole weazon is contracted in his membranous distances, and therefore it was, that this paire cleaueth to the whole length of it.

They are moreouer very slender, because the throttle easily descending with his owne waight did not require any great strength: yet notwithstanding they haue certaine *inscriptions* or neruous distinctions, such as are in the right muscles of the paunch, by which their length and tenuity is secured from danger.

Their vse is to draw downe the shield-gristle called *Thyroides*, and below to constringe or contract it, and so to dilate the cleft or fissure of the *glottis* or tounge-let in a base voice; they also doe somewhat contract the weazon, that it be not doubled when we speake, or the throttle too much dilated above.

The 2. paire.

The second paire of Common muscles [tab. 9. fig. 3. b] which *Vesalius* calls the first paire as also doth *Falopius* and some others; is situated likewise in the forepart of the *Larynx* or throttle, and are called *Hyooides*, or rather *Hyothyraoides* or the shield-bone muscles, these are opposed to the former and are farre shorter. They arise broad and fleshy almost from all the lower part of the bone *Hyois*, to whose inward sides they seeme to be continued; and with right fibres they creepe downward together, sauing that their inner sides doe depart one from another, and are each of them implanted with a broad and oblique end into the lower part of the Gristle *Thyrooides* which they wholly couer. Their vse is to dilate the lower part of the shield-gristle and to contract his vpper, and by drawing the throttle vpward to make the cleft shorter and narrower; so we may perceiue that in an acute or shrill voice the throttle moueth vpward; but if this muscle doe proceede obliquely backward as often it doth, then it mooueth the shield-gristle or *Thyrois* vpward and forward. I can giue no better reason of their shortnesse, but because the *Larynx* hath other helps to draw it vpward beside these: for the bone *Hyois* being mooued vpward by other Muscles, draweth the whole throttle vpward with it.

Table 9. The same with the 15. Lib. 8.

The 3. paire.

The third paire of common Muscles [tab. 9. fig. 7. ll] are seated in the backpart of the *Larynx*, they are called *oesophagæi* or the Gullet muscles, and truely some thinke they are muscles of the *oesophagus* or Gullet and not of the Throttle or *Larynx*, because they encompassse the gullet on euery side and are thought to helpe much in diglutition. They are altogether fleshy and large, and doe especially ly vpon the vpper part of the Gullet, which they encompassse saith *Galen* like a sphincter, three fingers breadth ouerthwart, and do almost cleaue vnto it.

Laurentius.

They arise from the sides of the Shield-gristle or *Thyrois* al along, where there appeareth a rough line, and passe above the gullet with their Fibres almost transuerse, and there in their extremities or ends they meet, yet so that they are distinguished by a white line running through their length, especially in beasts, for in a man it is oftentimes not visible, and beside the Fibres do not seeme to be diuided, so as they may easily be taken for one muscle. Their vse is, as they contract the sides of the Shield-gristle or of the *Thyrois*, so to presse it that they may binde and streighten the cleft; but as they encompassse the gullet & are drawne into themselues, so by a voluntary motion they help the swallow, and are somewhat assitant to the naturall Faculty as we haue partly opened before. And thus much of the common muscles of the throttle, now follow his proper.

Proper Muscles.

Of proper muscles there are ten (or five paire) sixe of them do dilate, and foure contract; they are called *Proper*, because they both arise from the *Larynx* to which they grow, and againe are inserted into it, imploying all their seruice to it alone, opening the cleft in inspirations or when we take in breath, and shutting it when we breathe out; besides they fasten together the two Cartilages or gristles, which do originally and of themselues helpe the forming of the voyce. Of these muscles some are before, some behinde, others without, others are placed within.

The 1. paire.

Originall.

The first paire of the proper [tab. 9. fig. 4. f, but in the 6. figure one of them is separated, the other remaineth in his place,] which are forward and vttermost we call *Antici Crycothyroidei* or the forward Ring-shield muscles: their situation is in the lower and forepart of the *Larynx*, they arise from the Cartilage cald *Crycois* or the Ring fleshy (but small and hauing oblique fibres) and proceede obliquely till they be implanted into the Basis of the shield-gristle or *Thyrooides* withinward, and in their whole progresse (their middle part only excepted) they are fleshy

fleshy and broad: and if you separate the lower proceffe of the shield-gristle or *Thyroides* from *Crycoides* or the Ring, and follow it with a section, you shall perceiue that there is one in each part.

The vse of these is to moue the *Thyroides* from above downward, to ioyne it to the *Crycoides*, to constringe the lower part of *Thyroides* and to dilate the vpper part, and by that meanes to open the *glottis* or cleft of the *Larynx*.

The second paire are called *Crycoarythenoidei postici*, the backward Ring-Ewer muscles. The 2. paire. [tab. 9. fig. 5. f.] Their situation is in the backside of the Ring-gristle and they arise narrow and fleshy from the lower and backe parts of the same gristle, and running vpward [tab. 9. fig. 5. f.] do fill a smooth cavity made for their sake in the backside of the Ring gristle which looketh toward the Gullet or *Oesophagus*; and at length becomming more large and strong with fibres somewhat sloping or oblique; they fall from the spine or rough line of the Ring-gristle, and are inserted on both sides neruous into the lower part of the Ewer-gristle where it is articulated with the Ring-gristle.

The vse of these is to returne the third Gristle backward to the outside of the *Larynx*, to open the cleft and dilate it to the sides, and so they further the base voice. But as they haue both right and oblique fibres, so they serue for diuers and mixed motions; with the right they draw the cleft backward and so open it; with the oblique they helpe to moue toward the sides; so that they open & enlarge the cleft both in the length and in the breadth of it.

The third paire are called *Crycoarthenoidei laterales* or the side Ring-ewer muscles. [tab. 9. fig. 4. r.] Their original is fleshy from the Ring-gristle where it is broadest, from whence they proceede directly vpward, and become larger and more fleshy, and are inserted to the sides of the Ewer-gristle at the articulation or ioynt, & do occupy all the root of the third gristle which the former paire do not touch.

Their office is outwardly to sunder the double Ewer-gristles, and to separate them one from another so much as the fifth paire drawes them together, and by that meanes they drine out the sides of the cleft and open the throtle. But because these muscles are seated, partly without, and partly within the capacity, happely on the outside they binde or contract the *Larynx*.

The fourth paire called *Thyroidei interni*, the inward shield-gristle, or *Thyroarthenoidei*, that is, the shield-ewer muscles, [tab. 9. fig. 4. c, tab. 8. fig. 1. c. e.] are broad, fleshy, and haue diuers fibres mingled and vnited together, and in their beginnig three inscriptions or distinctions as if they were three seuerall muscles, and are seated ouerthwartwise, in the capacity of the *Larynx* or throtle. They arise close one to the other from the inner, hollow and middle part of the shield-gristle (whose inward cavity they fill) along the whole length of it, and with oblique fibres they ascend vpward, growing narrower in the ascent, and are inserted into the sides of the ewer-gristle which forme the *tongue-let* or *glottis* following the sides of the cleft.

These are the largest and strongest of all the proper Muscles and almost equall all the Muscles of the throtle put together, and that for good reason, namely because in the retaining of the breath they were to resist all the Muscles of the Chest. For in drawing the parts of the Ewer-gristle, vnto the Shield-gristle, and in constringing them or gathering them together and thrusting the *tongue-let* forward, they shut it vp & are said to close the throtle. If in these Muscles there happen an inflammation it bringeth a mortall squinasy there appearing no rednesse neyther in the chops, nor in the mouth, nor in the necke. For in the squinasy sometimes the brest-bone, sometimes the necke looke red: the brest-bone because of the continuity of the weazon muscles, which we saide did arise fleshy from the vpper and inner side of the brest-bone and ran all along the weazon, and were inserted into the Shield-gristle.

The sides of the necke become red, because of the Gullet Muscles which arising from the sides of the Shield gristle doe encompassse the whole gullet like a sphincter: also the fore and vpper part of the necke looketh red, because of the continuity of the Shield-bone Muscles which arising from the bone *Hyois* are inserted into the lower part of the Shield-gristle couering the same wholly.

The fift and last paire called *Arytenoidei* or the Ewer-Muscles [tab. 9. fig. 4. and 5. g.] are scituated outward and backward about the gristle where it resembleth the figure of an Ewer or Water-spout, and where the gullet is ioyned to the throtle, and the third gristle is articulated with the second. They arise from the backe line or spine of the Ewer-gristle,

The vse of their double fibres.

The 3. paire

The 4. paire

The true and dangerous squinasy.

The 5. paire

gristle, and doe runne vp with the oblique fibres to the middle thereof, and where the two parts of the gristle are tyed together they also are ioyned and inserted. These are small, *Columbus* and *Archangelus* say they bee the least in the whole body: on the one side they bunch out like pears, but within they grow to the gristle, in the midst where they ioyned they are broader and thicker, as also where the white line appeareth, and seeme to grow into one in a common Tendon, then they become neruous for more strength that they might not be indangered in their perpetuall motion, especially when we hold our winde vpon occasion long; and therefore some haue accounted them for one muscle, some for two; and because they are on either side fleshy they are to be numbred among those that haue their Tendon in the middest, as is the fifth muscle of the lower iaw called therefore *Digastricus* or double bellied, and also the fourth paire of the bone *Hyois*.

Why the ewer-gristle must be double.

The most acute Squinasy.

The vse of all the muscles of the throttle.

How they differ from the muscles of *hyois* and the tongue.

The vse of these muscles is to moue the ewer gristle sidelong to the right hand and to the left; yea to constringe or knit the basis or foundation of the same, to draw both his parts together, to presse them one to the other, and so to straighten and close the cleft; whereby it is manifest that this third gristle was necessarily made double, for if it had bene single it could not haue bene straightned by these muscles nor shut by the fourth paire, nor opened by the second and the third paires. Moreouer these inward muscles being inflamed the most acute and sharpe Squinasy is ingendred: for when they swell, by reason of the abundance of the matter the outgate of the breath is hindered, and so the patient instantly suffocated, which we haue knowne in the hundreds of *Essex* to happen within 12. houres after the disease began.

The vse of the muscles of the Larinx or throttle as well common as proper, is to moue the gristles thereof with voluntary motion to the infinite modulations or diuers accents of the voyce: so that when part thereof, especially the vpper, is fitly dilated and straightned, or opened and shut; the cleft of it (which is the proper and immediate organ of the voyce) might be either dilated for a base, or streightned for making an acute or shrill sound, which verily the common muscles doe more manifestly, and the proper more obscurely. These muscles are altogether diuers from the muscles of the bone *Hyois*, and of the tongue: for if when they be at rest, you put your hand to your Larynx and offer to sing in base tunes, you shall perceiue the throttle to descend downward, and in shrill and treble you shall manifestly perceiue it to ascend vpwads.

CHAP. XX.

Of the muscles of the Epiglottis or the ouer-tongue.

Diuers opinions of the epiglottis.

In beasts two paire.

The 1. paire.

The 2. paire.

Alen is of opinion that the motion of the *Epiglottis* or ouer-tongue is in a man not voluntary but naturall, or at least he leaueth it doubtfull whether it haue any muscles or no. *Vesalius*, *Platerus*, *Columbus* and *Laurentius* thinke and resolute there are none, yet *Platerus* maketh question whether they be not found in such men as doe easily vomit. Of the same opinion also is *Banhinus*, *Aquapendens* thinketh the motion of it voluntary and performed by membranous muscles. For my owne part I dare not stickle in so nice a question. In beasts that chew the cud they al acknowledge that it hath muscles, those we will briefly describe for the helpe of young Anatomists who do often in the want of mens bodies dissect the throttles of Oxen or Sheepe to practise themselves.

There are therefore in beasts two paire of muscles belonging to the *Epiglottis* or ouer-tong, the first are called *Hyoglotti*, or the bone-tong, the second the Ewer-tongue muscles.

The *Hyoglotti* or bone-tongue muscles are seated in the backe of the ouer-tong, they arise from the middest of the inner part of the bone *Hyois*, and are inserted on either side into the Basis of the *Epiglottis* neare his middle. They raise vp the ouer-tongue after it is depressed in the swallowing of meate and drinke, to make free passage for expiration which otherwise would by it be intercepted.

The Ewer-tongue muscles because of the largenes of the Larinx or throttle are most euident in oxen. They arise fleshy from the vpper part of the Ewer-gristle at his articulation. At their original they are contiguous or touch one another, and for a great space seeme vnited and mingled, and run a long course keeping their proportion through the inside of the Shield-gristle, & at length retaining their vnion or conjunction are inserted into the inner Basis of the *Epiglottis* or ouer-tongue

CHAP. XXI.

Of the Muscles which moue the head.

The head is moued primarily or fecondarily. Primarily about the fecond rack-bone of the Necke or about the first: about the fecond eyther bending forward or extending backward: about the first it is moued as a Naue vpon an Axletree, or rather as the Poyle of a Watch vpon his Bridge. All these motions are performed by feuen or rather by nine proper paire of muscles, (*Falopius* in his *Observations* accounteth ten) 7. of which are *Extenders* and *Compassers*, and are fituated on the backe part in the necke; and two *Benders* which are placed in the forepart of the necke. The head is moued fecondarily and by accident when it followeth the motion of the necke: the muscles therefore of the necke moue the head but onely vnto the sides. For if the necke be not moued, wee cannot incline the head at all to the Shoulders.

The first paire are called *Splenij* or the splintes, because they are very like the rowled splints which Chyrurgeons vse when bones are broken. [*tab. 10. ΔΔ*, their originall is marked with 8, their insertion is with 9.] They are long and thicke, and on both sides rest vpon the racke-bones, and albeit they are very fleshy yet at their originall from the five vpper rack-bones of the Chest (for they rarely reach vnto the sixt) they are finewy. From thence they ascend vward and grow fleshy receiuing a new originall from the Ligaments of the rack-bones of the necke; some thinke they arise onely from hence, some from both places; howfoeuer, their ascent to the head is not direct but somewhat oblique, and from that part of them which proceedeth out of the spines of the chest are produced 2. membranous

Nine paire of Muscles.

The 1. paire

Originall double.

TABVLA. X.



Tab. 10. Wherein some Muscles of the head, the Chest, the arme, and the shoulder blade are described.

1, The proeesse of the shoulder-blade, called the top of the shoulder.

O, The fourth Muscle of the arme or the greater round muscle to which *Falopius* his right muscle is adioyned, which some call the lesser round muscle.

22, The sixt muscle of the arme or the vpper bladerider.

X, The 2. muscle of the shoulder-blade or the *Leuator* or *heauer*.

Z, The second muscle of the Chest or the greater *Saw* muscle.

Γ, The fift muscle of the chest or the muscle called *Sacro-lumbus*.

α β, His place wherein he cleaueth fast to the longest muscle of the backe.

γ γ, The Tendons of this muscle obliquely inserted into the ribs.

ΔΔ, The first paire of the muscles of the head or the *Splinters*.

Ch. 8, 9, Their length whose beginning at 8 and insertion at 9.

10, 11, the sides of this Muscle.

12, that distance where they depart one from the other.

13, the two muscles called *Complexi*, neare their insertion.

φ, The second muscle of the backe or the *Longest* muscle.

Ω, The fourth muscle of the backe or the *Semi-spinatus*.

δ, The shoulder-blade bare.

P, A part of the transuerse muscle of the *Abdomen*.

V v v

Ten;

Tendons which are inserted into the transverse processes of the first & third *Vertebra* of the necke, or sometimes of the second, third and fourth: *Laurentius* will haue them to haue a double insertion; one part of them into the transverse processes of the second Rack-bone, another part into the *Occipitium* of the head toward the sides of the *Labdall* suture, and thither I am sure their fleshy part reacheth. For they are neruous in the Chest, and fleshy from thence forward, their fibres running obliquely vpward from the spine of the lower to the transverse processes of the vpper racke-bones, all of them at length determining in the Nowle: yet *Columbus* saith they are right as long as the two muscles ioyne, and become oblique but after their diuision. For where they arise at the spine of the Chest they make a sharpe nooke or angle which is dilated as they ascend, and about the third Racke-bone of the necke the right is seuered from the left with a notable distance [tab. 10. character 12] so as the space betweene them resembleth a triangle [tab. 10. char. 9, 10, 12.]

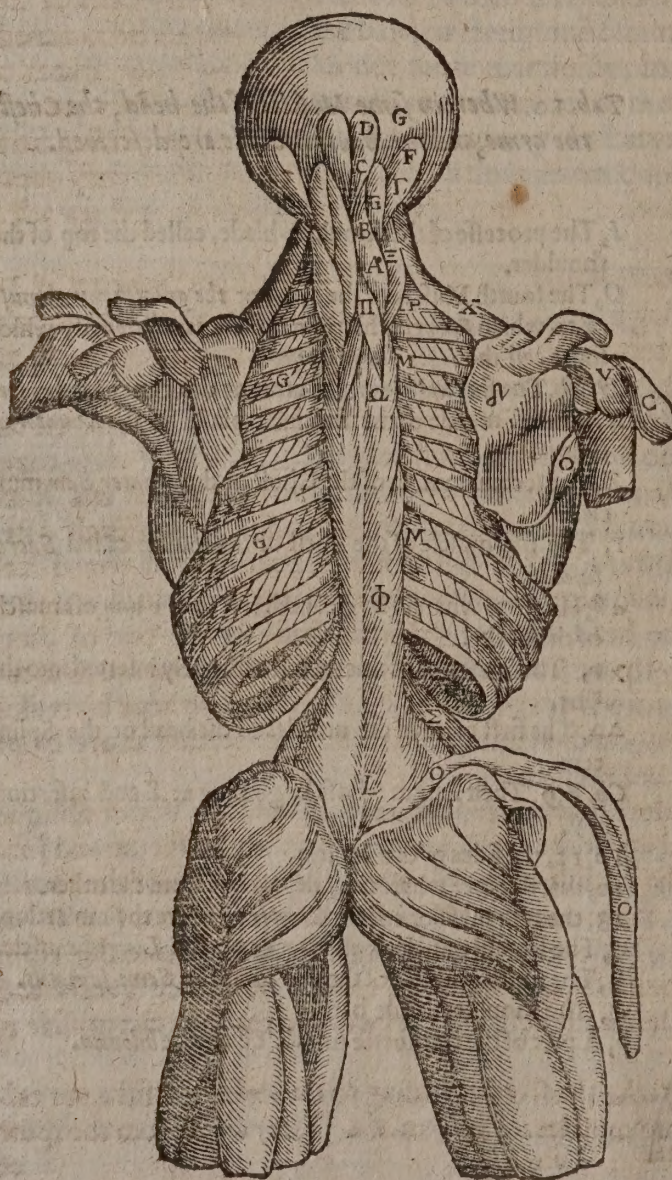
Their Implantation is broad and fleshy into the Nowle [tab. 10. from 11, to 9.] and so they haue three sides: one from their beginning to their parting asunder; the second from thence to the Nowle; the third from the nowle backe to their originall. *Falopius* hath obserued that sometimes they are inserted with a neruous particle into the proceffe called *Mammillaris* or the Teat-like proceffe.

The vse of this paire is when they both moue, to draw and extend the head directly backward: but when one of them onely worketh then they turne the head to the sides, and the right moueth somewhat backward saith *Archangelus*.

The 2. paire.

The second paire are called *Complexi* [tab. 11. A B C D E F] or the brayed Muscle, because they are wouen and brayed together with the third and fourth Muscles of the necke like a flat point wouen of diuers threds, or else because of the diuers formes. For their ori-

TABVLA. XI.



Tab. 11. sheweth some Muscles of the Head, the Backe, the Chest, the Shoulder-blade and the Arme.

A D, the second paire of the Muscles of the head or the two *Complexi*, the first part is at A D.

B C, the second part. E F, the third part rising vp vnder G and inserted at F.

G, the fourth part of this muscle or the right muscle of the head according to *Falopius*, which *Vesalius* made the 4. part of the 2.

G G, (Betwixt the ribs) the externall *Intercostal* muscles.

L, the originall of the 2. muscle of the backe.

M, His tendons at the rack-bone of the necke.

The vpper O the fourth muscle of the arme or the greater round muscle.

O O, the lower, the 6. muscle of the Chest or the *Sacrolumbus* hanging from his originall.

Q, The sixth muscle of the arme or the vpper *Bladerider* inuerted.

V, The third ligament of the ioynt of the arme.

X, The fourth muscle of the shoulder-blade or the *heauer*.

Z, The second muscle of the Chest or the greater *Saw-muscle*.

E, the 3. muscle of the necke called *transuersalis*.

Π, the 4. muscle of the necke called *Spinatus*.

S, the first muscle of the backe or the *Square muscle*.

Φ, the 2. muscle of the backe or the *Longest* whose originall is at L and his tendons at the *vertebrae* at M M. (natns.)

Ω, the fourth muscle of the backe called *Spi-*

δ, the backe of the shoulder-blade stayed.

ginals.

ginals are of diuers fashions, and they are diuersly also inserted into the Nowle or *occiput*. They haue many tendinous parts, and many also fleshy, so that each of them seemes to be compounded as it were of three seuerall Muscles, or rather hath three Originals. The first ariseth farre off with a sharpe originall even out of the Transuerse proceffe of the fourth and fift rack-bones of the Chest, this immediately after his springing appeareth fleshy [at A] and of the fashion of a Mouse, when it attaineth vnto the beginning of the Necke [at B] it ceaseth to be fleshy and endeth as it were in a round Tendon, and hauing overcome the roote of the necke at [C] it groweth fleshy againe (as the Muscle of the bone *Hyois* called *Digastricus* or double-bellied) and so is inserted in the middle of the Nowle-bone. [at D]

The second originall or beginning of this Muscle is shorter, growing round and neruous out of the spine of the 7. racke bone of the necke [at C.] *Platerus* addeth sometimes of the first, and sometimes of the second; as it ascendeth it becommeth fleshy and is mingled with the former before at his insertion he is implanted into the nowle. The third [tab. 11. from E to F] is situated in the side and springeth partly fleshy partly neruous from the transuerse or ouerthwart processes of the second and first racke-bones of the Chest. *Platerus* addeth from the five lower of the necke. From thence it proceedeth obliquely outward and becommeth fleshy and broad and is inserted into the Nowle at the root of the Mammillary proceffe, but it is not of the same forme in Dogs and Apes. These muscles if they worke together, they extend the head directly drawing it backward, if eyther of them mooue alone, the head is drawne round to one side. *Archangelus* addeth a little also backward by the right, and forward by the left.

The third paire (which *Vesalius* reckoneth for the fourth part of the second Muscle, being deceyued faith *Falopius* by certaine fibres of one of the muscles of the backe which grow to the beginning of it) [tab. 11. GG] is not very great or thicke & is situated vnder the second paire. They arise Neruous from the transuerse processes of the six first rack-bones of the necke; sometimes also but rarely from the five vppermost of the chest; then it becommeth fleshy and stretcheth obliquely vpward and inward, their Fibres reaching to the spines of the bones, and at their insertion which is to the backward roote of the Mammillary proceffe they end Neruous, receiuing an additament or encrease by two small portions arising from the transuerse proceffe of the first racke-bone of the Necke. Their vse is when they moue together to lead the head lightly backward; if either of them worke alone it draweth it backward to one side.

The fourth paire which are called *Recti maiores* the greater right Muscles [table 12. A B] are yet small, fleshy and slender, arising from the top or height of the spine of the second bone of the necke at [E] where they touch one another, but presently part againe and ascend both vpward and end round in the middle of the Nowle or *Occipitum*.

The fift paire called *Recti Minores*, the lesser right muscles [tab. 12. F G] are situated vnder the former and are like them in substance, forme and progresse. They arise close together from the backe part of the first *Vertebra* where the bone should haue ended in a spine but that spine is wanting, because it would haue offended those muscles: presently after their originall they part and ascend vpward, and on eyther side are implanted round into the middle of the Nowle. The two last paires haue one and the same vse, which is if they mooue together directly to extend the head drawing it backward, but if one of them mooue alone, it mooueth it circularly to one side. Now the reason why there are so many muscles appointed to draw the head backward, is because the forepart of the head by reason of the face and neather Iaw is very heauy and weighty, and therefore needed more helpe to retract it, whereas it noddeth forward very easily.

The sixt paire, according to *Vesalius* the fift, are called *Obliqui superiores* the Vpper oblique muscles; [tab. 12. H I] they are seated vnder the right, and are like them in forme and substance: smal they are and arise out of the middle of the Nowle at the vtter side of the fourth paire, thence they descend downward, & are ouerthwartly inserted into the top [at D] of the transuerse processes of the first rack-bone of the Necke, the right muscle into the right proceffe, and the left into the left. Their vse is, if they both mooue, to nodde gently and directly backward, if one alone then the head enclineth backward to that side the muscle is on which mooueth.

The seauenth paire, according to *Vesalius* the sixt, according to *Columbus* the fift, are called *Obliqui inferiores*, the lower oblique muscles. [tab. 12. K L] They arise from the spine

The second

The third.

The 3. paire.

The 4. paire.

The 5. paire.

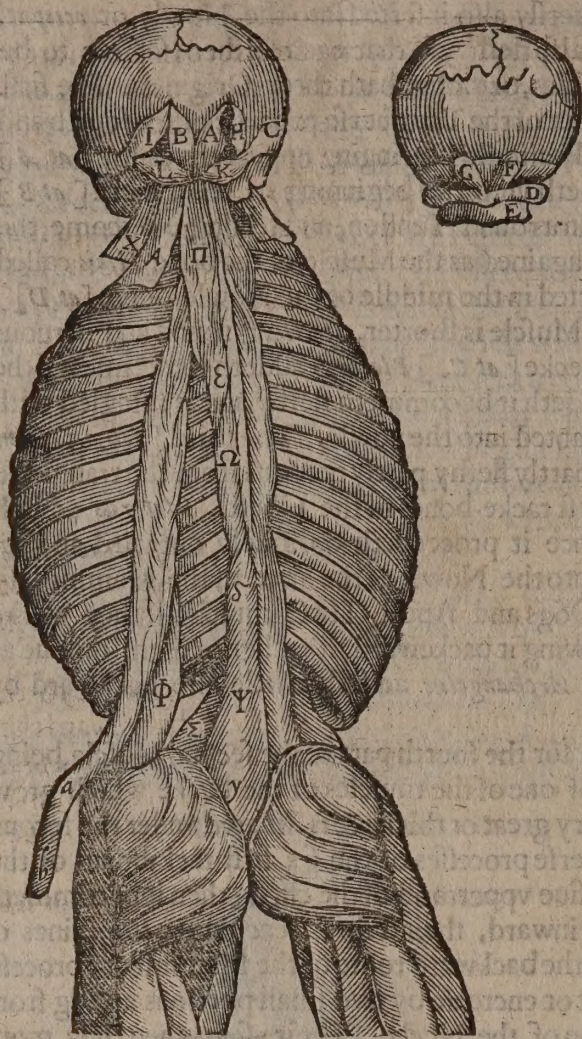
The vse of the two last paires.

The 6. paire

The 7. paire.

TABVLA XII.

Sheweth the Muscles of the Head and the Necke.



AB, The third paire of the Muscles of the head called *Reli Maiores*.

C, The Mammillary processe.

D, The transuerse processe of the first rackebone.

E, The processe of the 2. rackebone of the necke.

FG, The fourth paire of muscles of the head called *R. Miniores*.

HI, The fifth paire of muscles of the head called *Obliqui Superiores*.

KL, The sixth paire of muscles of the head called *obliqui Inferiores*.

X, the fourth paire of Muscles of the shoulder-blade

A, the second muscle of the necke called *Scalenus* which *Falopius* maketh the 8. muscle of the Chest.

Π, The fourth muscle of the necke called *Spinatus*.

Z, the first muscle of the backe called *Quadratus*.

φ, the second muscle of the backe called *Longissimus*.

α, The *sinus* or bosome of this Masele, whereby it giueth way vnto the third muscle of the backe, called *Sacer*.

β, His Originall.

γ, the third muscle of the backe called *Sacer*.

δ, His originall.

ε, His end.

ζ, the fourth muscle of the backe called *Semispinatus*.

η, His vpper end vnder the 4. Muscle of the necke

of the second rack-bone of the necke [from B to D] and passing obliquely vpward are implanted into the transuerse processes of the first *Vertebra*. These, as also the oblique superiors are longish, round and fleshy (farre larger in Dogs and Apes then in men) and do make a triangle of equall sides.

The vse of this seuenth paire is semicircularly to mooue the head (for it hath not perfect circular motion) with the second *Vertebra* vpon the first when one mooueth alone. If they both mooue, either they keepe the head steddy as *Falopius* in his obseruations conceiueth, or else do draw it backward a very little, even so much as may rather giue rest to the second rack-bone then motion; for the motion and rest of the head followeth the motion or rest of that second *vertebra* or rack-bone.

The 8. paire.

The eight paire which is the seuenth according to *Vesalius* are called *Mastoides* [table 6. fig. 2, R. the latter tab. 7. fig. 2. B] They are seated forward toward the face next vnder a membranous and broad muscle in the necke; [tab. 6. fig. 1. r] strong they are, long and round, and

Situation.

do appeare in leane carkasses vnder the skin before it be dissected, yea in living bodies, and these are they which the Ancients so diligently obserued in their Coynes. They arise from the middest of the top of the brest-bone [at p] and from a part of the *Clauicle* where it approacheth neere the brest-bone [at σ] to be articulated with it: at which their originall they are Nervous and broad, but more nervous where they arise from the brest-bone, and

Originall.

from thence ascend obliquely vpward and become fleshy and thicke, and are obliquely inserted with a fleshy and thicke end into the Mammillary processe (which they compasse with their largenesse) and into the backpart of the *Nowle*. [tab. 6. figure 2. the vpper T] And this muscle by reason of his double originall betweene which there is a kinde of hollownes [betweene p and σ f 2.] because it seemeth as if it might be diuided into two, some

Infertion.

do diuide it into many. Their vse is if they moue together to bend the head forward into the bosome as when we nodde, either carrying the necke stiffe or inclining it: if one of them onely worke then the head is mooued forward to the left side if it be the right Muscle, and to the right side if it be the left, which motion we may plainly perceiue in guiding a horses necke with the reines. This paire with the second paire of the bone *Hyois* [tab. 6. fig. 2. γ γ] make a crosse in the Necke.

Vse.

The

The 9. paire [*tab. 13. at the side of AB*] is added by *Falopius*, described in some sort by *Galen*, and is situated vnder the gullet in the forepart of the necke & it is a diuerse muscle from the first paire of the necke [*tab. 13. AB*] to which it adioyneth. It ariseth neruous from the Ligaments of the rack-bones of the necke, which Ligaments or Chords doe arise from al the transuerse proceffes of the rack-bones of the necke, especially from the 7, 6, 5, 4, & 3.

After his originall this Muscle groweth somewhat fleshy, and ascending vpward is inserted with a fleshy end into the Basis of the head betwixt the two proceffes where the head is articulated with the first *vertebra*. His vse is when we nod to bend the head somewhat forward. And thus much of the Muscles of the Head.

CHAP. XXII.

Of the Muscles of the Necke.

THe Muscles which mooue the necke primarily, and secondarily or by accident the Head, are on either side three, or foure if you adde the *Scaleni*, which we account rather among the muscles of the Chest: these are situated vnder the Muscles of the Head, some of them before at the sides of the necke, some of them behinde.

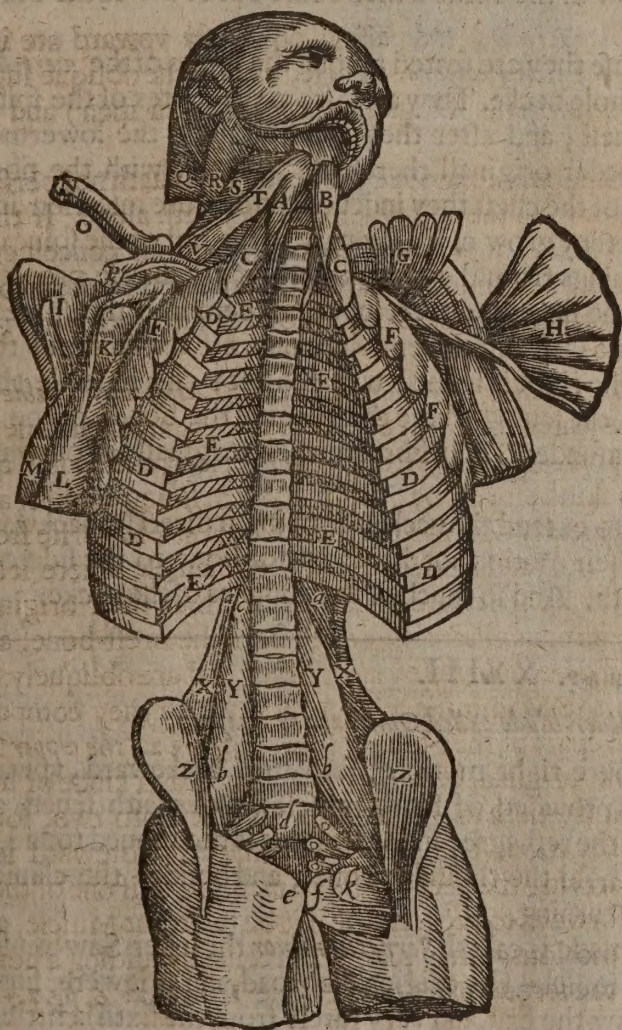
These motions of the Necke are to bend forward, to extend backward, to incline to the sides and to turne round as it were: but there are more Muscles to draw it backward then forward, because the labour is greater by reason of the waight of the Necke and the Head.

The first paire are the two Long Muscles [*tab. 13. AB*] which are seated in the forepart of the Necke vnder the gullet, wherefore they are also called the *vnder Gullet-lurkers*. These

The motions
of the necke.

Tab. 13. sheweth the canities of the middle and the lower Bellies, all the Bowels being taken out where the Bones and Muscles do remaine, excepting the Breast bone.

TABVLA XIII.



AB, The first muscle bending the neck called *Longus*.

CC, The second bender of the necke called *Scalenus*.

DDDD, The outward *intercostall* muscles.

EEEE, The inner *intercostall* muscles.

FFFF, The second muscle of the chest called *serratus maior*.

G, The first muscle of the shoulder-blade called *serratus minor* separated from his originall.

H, The first muscle of the arme called *Pectoralis*, separated from his originall.

I, The 2. muscle of the arme called *Deltoides*.

K, The bone of the arme without flesh.

L, The first muscle of the cubit called *Biceps*.

M, The second muscle of the cubit called *Brachialis*.

N, The clauicle or collar-bone bent backward.

O, The first muscle of the chest cald *subclanius*.

P, The vpper proceffe of the shoulder-blade.

Q, The first muscle of the head called *obliquus inferior*.

R, The second muscle of the head called *Complexus*.

S, The fourth muscle of the shoulder blade called *Leuator*.

TV, The two bellies of the fourth muscle of the bone *Hyois*.

XX, aa, The fift muscle of the backe whose originall is at *aa*.

TY, bb, cc, the sixt muscle of the thigh called *Psoa*, whose originall is at *cc* and tendon at *bb*.

ZZ, the seauenth muscle of the thigh.

d, the holy bone. *ooo*, the holes of the holy bone out of which the nerues do yssue.

e, A portion of the fift muscle of the thigh arising from the share-bone.

f, the share-bone bared.

g, the ninth muscle of the thigh or the first *circumflexor*.

arise with a fleshy thin and sharpe beginning from the body of the fifth racke bone of the chest where the rib is articulated to it, and ascending broader doe grow to the five vpper *vertebra* of the chest and all of the necke. They also as they ascend by degrees do approach or incline one to the other, yet so as they leaue the middle part where the gullet descendeth vncouered, but at their determination they ioyne in a neruous and sharpe Tendon, and are implanted into the bunching proceſſe of the first racke bone: sometimes but rarely they are implanted and that obscurely into the nowle, euen at the great perforation thereof; so that it may seeme the nowle is turned by them. Their vse is by their proper motion when they worke together, to bend the necke directly forward and withall to incline the head, but if one of them moue alone, then is the necke inclined forward into that side which is contracted, or on which the muscle moueth.

The 2. paire. The second paire make those which are called *Scaleni* and are accounted as the 8. muscle of the Chest. [tab. 13, CC, tab. 12, A] Their situation is on the sides of the necke rather before then behinde. They are esteemed to arise fleshy and large from the first rib, and to bee inserted into all the transuerſe proceſſes of the rack-bones of the necke, excepting sometimes the first & the second; from which we thinke with *Falopius* they haue their originall. Their vse is also thought to be, to bend the necke forward as doth the first paire: this one thing is peculiar to them saith *Vesalius*, and *Platerus* consenteth, that they haue a through-passage by which the veines and arteries do run into the arme.

The 3. paire. The third paire (which *Vesalius* maketh the third paire of the backe, but *Platerus* the third paire of the necke) are called *Transuersales*, or the two ouerthwart muscles. [table 11, E] Their seate is in the backe, and they arise from the rootes of the transuerſe proceſſes of the fixe vppermost racke-bones of the Chest, from whence by degrees they become stronger and thicker, and are inserted into the outside of the transuerſe proceſſes of all the bones of the necke, but more rarely into the first. Sometimes they haue two other originals, one from the second paire of muscles of the backe, the other from the fift paire of the Chest, which together make vp these muscles. Their vse is, if they worke together to extend directly backward, if one of them alone the motion is not direct but oblique. Also between these do passe those nerues of the marrow of the backe which come out of the racke-bones of the necke.

The 4. paire. The fourth paire called *Spinati* because they are seated among the spines of the *vertebra* [tab. 12, H] do occupy or take vp the whole necke. They arise from the rootes of the spines of the seauen vppermost bones of the chest; and after they haue attained the lowermost *vertebra* of the necke, they gather a broader originall therefrom, and yet with the fibres which they receiued from the *vertebra* of the chest they indeuour an obscure insertion into the spine of the lowermost *vertebra*; but they grow more strongly to the rest of the spines of the necke bones, and draw new beginnings from the rootes of their transuerſe proceſſes euen to the second *vertebra*, and insert the fibres they receiue from them into the spine of the rackebone next aboue, till they haue implanted themselves ouer all the spine of that second racke bone of the necke, where the right is ioyned with the left: and indeede they ioyne all along their progresse vp the necke sauing where the spines of the bones peepe vp betweene them and seuer them a little asunder. Their fibres at their originall are outward, but as they ascend they incline inward.

Their quaint passages.

Their vse is if they worke together, to extend the necke, drawing it directly backward, but if one of them moue alone then is their motion not direct but oblique to the side contracted, or on which the muscle moueth. And so much of the muscles of the necke.

CHAP. XXIII.

Of the muscles of the Shoulder-blade called *Omo-plata* or *Scapula*.

Why the shoulder-blade doth not moue round.

THe Shoulder-blade hath foure right motions, forward, backward, vpward, downeward: for which it is provided of foure muscles, *Galen* saith seuen, and *Sylvius* reckons five, but all the rest agree in foure, for it is not moued round, for then it could not so firmly hold the shoulder bone; and besides the clauicles being fastned vnto it do keepe it from turning.

The 1. muscle.

The first muscle of the Shoulder-blade is called *Serratus minor* the lesser Saw-muscle, [tab. 14, S] it lieth vnder the pectoral muscle. His originall is broad, and as it were, finger-fanged from the 4. vpper ribs (excepting the first, and very rarely from the sixth) a little before

Table 14. sheweth the body, as it appeareth after the Bowels of the Lower and Middle Bellies are taken away. The right Arme with his Muscle remaineth in his naturall situation, except the Pectorall and the lesser Saw-muscles, which were necessary to be separated and taken away with the Breast-bone. The left Arme is remooved from the side, that the blade of the shoulder and the Clavicle, and those things which ly vnder them might better appeare.

TABVLA XIII.



AA, The first muscle of the cubit called *Biceps*.
B, the second muscle of the cubite in the left arm, called *Brachialis*.
DE, the first paire of muscles of the necke vnder the gullet.
F, the second of the necke arising from the first rib.
GGG, the outward *intercostall* muscles.
HHH, Letters set vpon the ribbes which should haue bene placed vpon the inner *intercostall* muscles.
I, The left clauicle or collar bone remooved from his place and bared.
K, the right clauicle or collar-bone in his own place.
L, the first muscle of the arme called *Pectoralis*, remooved from his originall.
aβγ, the circumscription of this muscle.
δ ε, His tendon and insertion.
M, the second muscle of the arme called *Deltoideus*.
ζ H, his originall and insertion.
N, the same muscle separated & reclined from his originall.
O, the fourth muscle of the Arme called *Rotundus maior*.
Q, the 3. muscle of the cubit or the *extensor*.
R, the 7 of the arme called *Subscapularis*.
υ, His insertion into the arme.
ξ, the tendon of the third muscle of the arme called *Latissimus*.
S, the first muscle of the shoulder-blade called *Serratus minor*, cleuated from his implantation.
TT, the 7. muscle of the thigh called *Iliacus internus*.

T, the first muscle of the Chest called *Subclavius*. **ZZ**, the 2. muscle of the Chest called *Serratus maior*. **22**, the first muscle of the backe called *quadratus*. **Ω**, the round *Pronator* or incliner of the *Radius* or wand. **α α**, the first bender of the Leg. **β β**, the 2. bender of the Leg. **σ σ**, the first paire of benders of the thigh called *Lumbales*, whose head is marked with **σ** and his tendon with **β**. **υ υ**, the third paire of benders of the thigh. **φ φ**, Paires of nerues which goe vnto the thigh. **π**, the Holy bone.

fore they end into their gristles; that his originall might be the firmer: & ascending obliquely vpward, it groweth fleshy and neare the ioynt narrow, and hauing fashioned the figure of a Triangle is inserted with a tendon partly fleshy partly nervous, into the shoulder-blade neare the inner proceffe called *coracoides*. His vse is to bend the shoulder-blade forward to the Chest; for if his vpper fibres be contracted it moueth it to the brest higher, if his lower, lower; if his middle fibres, then directly or in a straight line.

The second is called *Cucullaris* or the Monkes-hood [tab. 15. T] because with his other companion it couereth the backe as a hood doeth, or as a countrey wiues broad white kerchiefe, *Galen* calleth it *Trapezius* or the Table-muscle. His originall is fleshy and thinne, and transuerse or rather oblique from the Nowle; [from **σ** to **α**] but membranous and broad from the toppe of the spines of the necke even vnto the height of the Chest: [from **σ** to **π**] from thence it is straightned as it passeth toward the shoulder-blade, and is implanted fleshy and sinnewy into the spine of the blade, the top of the shoulder-bone and the middle almost of his Basis, and into the broader part of the *Clavicle*. [τ υ] Where it looketh toward the necke of the blade, you shall meete with a membranous and nervous semicircle [φ] ordained haply least it should too straightly presse the muscle which sitteth vpon the gibbous part of the shoulder-blade. [A]

TABVLA XV.

Sheweth the muscles on the backside of the body.



- A, A part of the 1. muscle of the cubit called *biceps*.
 B, The vpper and viter part of the second muscle of the cubit called *Brachiam*.
 C, The third muscle of the cubite.
 D, The fourth muscle of the cubite.
 K, The insertion of the seventh muscle of the head called *Mastoides* into the mammillary proceffe.
 M M, The second muscle of the arme called *Deltoids*.
 N N, The third muscle of the arme called *Latissimus* circumscribed with $\lambda \mu$, a part of whose tendon at the insertion in the former table is noted with ξ .
 T, The vpper part of the Cowle muscle.
 O O, The fourth muscle of the arme called *Rotundus maior*.
 P P, The fifth of the arme called *super-scapularis inferior*.
 II, The first part of the *supinator* of the *Radius* or wand.
 *, A portion of the oblique descendent muscle of the *Abdomen*.
 T, The second muscle of the shoulder blade called *Cucullaris*.
 $\sigma \pi$, The originall of this muscle from the nowle.
 $\rho \sigma$, From the spines of eight rack-bones of the chest.
 From σ to π from the spines of the necke.
 $\tau \nu$, His insertion into the spine of the blade, into the arme and clauicle.
 φ , His membranous semicircle.
 β , The fift muscle of the leg called *Semimembranosus*.
 χ , The fourth muscle of the leg called *biceps*.
 $\delta \epsilon$, The 3. muscle of the leg called *Seminervosus*.
 ζ , The fleshy part of the first muscle of the leg or of the first extender.
 η , The seventh muscle of the leg, or the second extender covered ouer with the membranous tendon of the sixt.
 $\mu \mu$, The first muscle of the thigh, or the first author of the buttocks.
 $i k l m n$, His originall at $i k l$, his insertion at $m n$.
 ν , the 2. muscle of the thigh hidden almost by the former.
 ρ , A part of the fifth muscle of the thigh called *triceps*.

The 5. lines
of this muscle.

It is circumscribed or limited with five lines; the first is ouerthwart at the nowle, [from σ to π] the second runneth straight along the spines, [from σ to ρ] two are oblique, one of them from the eare to the canell bone, the other from the end of the straight line which I sayd did run along the spines. [tab. 15, from τ to ϵ] The fifth & last is transuerse in the middle of the muscle where it is inserted into the spine of the blade, the top of the shoulder and the broad part of the cannell bone or clauicle. Wherefore this second muscle as well by reason of his diuers originall as also his seuerall kindes of fibres, moueth the shoulder-blade diuersly. For when the fibres which run along obliquely downward from the nowle and the spine of the necke are retracted, that is, when the vpper part of the muscle is retracted [at T] then is the shoulder blade lift obliquely vpperward: but when the fibres which proceed from the spines of the chest obliquely vpperward are gathered into themselves, that is, when the lower part is crumpled together [tab. 15, Δ] then the blade is drawne downward, but if the middle or the transuerse fibres be contracted [at σ] then the blade is directly led to the backe.

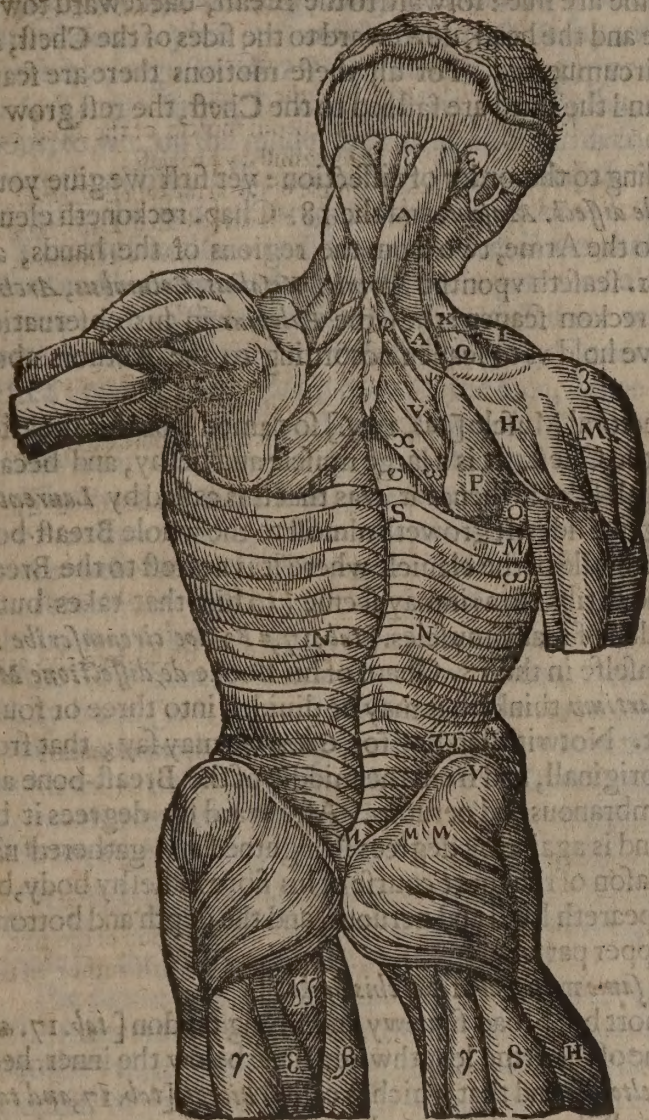
The third
muscle.

The third muscle is called *Rhomboides*, that is, the square muscle, [tab. 26, ν] It is situated vnder the former, thin it is, broad and foure cornered, and groweth fleshy from the spine of the three lower rack-bones of the necke and the three vpper of the chest, and his fibres run oblique from the backe to the bottome or foundation of the blade, into which basis of the blade it is also being-broad, fleshily inserted after the length of it, and draweth it vpperward somewhat and backward, and coucheth it to the backe.

The

Tab. 16. sheweth some Muscles of the Head and the Chest, the Cowle-Muscle being taken away, as also of the Blade and of the Arme.

TABVLA. XVI.



- A, The prominent part of the fourth muscle of the Chest called *seratus posticus superior*.
- A, the first muscle of the head called *splenius*.
- E E, the insertion of the second muscle of the head called *Complanatus*.
- I, the collar bone bared.
- M, the backpart of the second muscle of the arme called *Deltoid*.
- z, His backward originall.
- h, His implantation into the arme.
- N N, the fourth muscle of the arme called *Latissimus*.
- S u, His originall from the spiaes of the racke-bones, and from the holy bone.
- π, the connexion of this muscle with the hanch-bone which is led in the inside from π to π.
- ω, the place where it lieth vpon the lower angle of the Blad of the shoulder-blade.
- O, the 4. muscle of the arme called *Rotundus maior*.
- c, Some muscles of the backe do here offer themselves.
- P, the fift muscle of the arme called *superfascularis inferior*.
- Q, the sixt muscle of the arme called *Superfascularis Superior*.
- S, the beginning of the third muscle of the arme called *Latissimus*.
- X, the third Muscle of the Blade called *Rhomboides*.
- o X, His originall from the spines of the rackebones.
- 4 ω, His insertion into the Basis of the shoulder-blade.
- x, the 4. muscle of the Blade called *Leuator*.
- * A part of the oblique descent muscle of the Abdomen.

The other Letters in the thigh haue the same reference which they had in the former Table.

The fourth Muscle is called *Leuator* or the Heauer [table 16. at X] and is situated about the clauicle. His originall is very diuerse (whence it is that some haue made diuerse Muscles of it) from the transuerse processes of the racke-bones of the necke, and commonly from the 1, 3, 4, 5. but rarely from the second. But these diuers originals do soone grow into one, and passing downe do make a strong and fleshy muscle, which is inserted with a broad and fleshy tendon (his Fibres being all of them almost right, few oblique) to the vpper and inner angle of the shoulder-blade. His vse is to draw the blade vpward toward the forepart and to the sides of the necke.

These are the Muscles by which the blade is moued originally, the arme by accident, as also the blade is moued by accident by the Muscles of the arme, for when they draw the arme, they draw the blade also by consecution which is annexed thereto.

CHAP. XXIII.

Of the Muscles of the arme.

He Ancients called all that the Hand which is betwixt the top of the Shoulder and the Fingers. The first part therefore of the whole Hand is called in Latine *Humerus*, which we translate the Arme, and it reacheth from the top of the shoulder to the next loynt or bending of the Cubit, which we call the Elbow. The *Gracians* call this part *Brachion*, and the cavity which is vnder the loynt at the shoulder is called *Ala* the *Arme-pit*. The toppe iust against the pitte is properly called the *Shoulder*. This member that it may

The particular parts of the arme.

may more easily be moued euery way is articulated with the shoulder blade by *Enarthrosis* (which kind of articulation we shall make plaine in the Booke of Bones) and moued by Muscles.

The voluntary motions of the Arme are five: forward to the Breast, backward toward the backe, vppward toward the necke and the head, downward to the sides of the Chest, and finally, it is moued in compasse or circumuerted. For all these motions there are seauen Muscles: some of which as the first and the third are fastned to the Chest, the rest grow vnto the shoulder-blade.

All these we will describe according to the order of dissection: yet first we giue you to vnderstand that *Galen* in his Booke *de dissect. Muscul.* and the 18. Chap. reckoneth eleuen, three ascending from the Breast vnto the Arme, two from the regions of the hands, and five from the shoulder-blade, the 11. seareth vpon the *Epomis*. *Vesalius*, *Columbus*, *Archangelus* and *Falopius* in his institutions reckon seauen; the same *Falopius* in his obseruations and *Laurentius* account eight. But we hold vs to seauen according to the Authors aboue named and *Bashine* with them.

The first

The first is called *Pectoralis* the Pectoral Muscle [tab. 17. L.] so named from his situation, because it occupieth the forepart of the Chest. It is a large muscle and fleshy, and because of his originall it consisteth of vnequall sides: whence it was that it is called by *Laurentius* *Pentagonus* or *quingulaterus* as hauing five sides. It groweth almost to the whole Breast-bone & the gristle thereto annexed, to the middle of the clauicle where it is nearest to the Breast-bone and to the gristles of the 6, 7, and 8. ribs: so as it may seeme (to him that takes but an ouert view thereof) to be compounded of many muscles. [tab. 17. & by doe circumscribe it, and table 18. figure 1.] Yea *Galen* himselfe in the 18. Chap. of his Booke *de dissectione Musculorum*, and the 13. of the 13. *de vsu partium*, thinketh it may be diuided into three or foure, but *Columbus* reprehendeth him for it. Notwithstanding for *Galen* we may say, that from the clauicles it ariseth with a fleshy originall, and from the middle of the Breast-bone and the gristles of the ribs which are membranous and neruous. Afterward by degrees it becommeth thicker and more fleshy, and is againe by degrees straightned and gathered narrow, reseruing in the vpper part by reason of the short course of his fibres a fleshy body, but below long before his insertion it appeareth liuid and neruous, and the depth and bottome thereof is much slenderer then the vpper part.

His originall diuers.

[Tab. 17. is the same with Tab. 14. of this booke.]

Implantation.

At length it is implanted with a short but broad sinewy and strong tendon [tab. 17. and tab. 18. figure 1, and 2. S.] to the bone of the arme lengthwise a little below the inner head thereof, betwixt the muscle called *Deltoides* and that which is called *Biceps*. [tab. 17. and tab. 18. fig. 1. M A] But at his implantation he bendeth forwards as if his tendon were reduplicated. And truly in some men a portion of it is found to grow into a kind of point, immitating a peculiar muscle, whereas indeed it is a part of this muscle we now entreat of. Albeit *Columbus* thinketh that *Galen* in the 18. Chap. of his Booke *de dissect. Muscul.* describeth this production for a particular muscle.

His use.

This *Pectorall* muscle by reason of his diuers originall hath also diuers fibres: some run obliquely downward from aboue, others obliquely vppward from below: in so much that a little before the muscle produceth his tendon these fibres seeme to intersect one another in a decussation, and yet all of them concur together into one angle to forme the tendon. This variety of fibres maketh the different motions which this muscle performeth.

The office of this muscle is when it contracteth equally all his fibres, especially the middlemost in euery part of his body, to moue the arme equally and directly forward, inclining on neither hand, and to leade it to the breast. But if all the fibres be not equally contracted, then is it led indeed to the Breast but obliquely, more vppward or more downward as the different fibres are contracted.

The second

His name.
What *Epomis* is.

The second Muscle of the arme is, called *Deltoides*, from the forme of the Letter Δ : [tab. 17. tab. 18. figure 1, 2, 4. M] some call it *Epomis*, because it lyeth vnder the lesser head of the arme which is properly called *Epomis* by *Hippocrates*, *Galen*, *Ruffus* and *Oribasius*, as *Falopius* in his obseruations hath very well obserued, thereby clearing no small Controuersie in our Art about the acception of the word *Epomis* in *Hippocrates* and the Ancients. Some call it *Humeralis* or the Arme-muscle by a kinde of excellency.

It is fleshy and triangular, or *tetragonall* sayeth *Archangelus*, arising from the middlest of the clauicle where it regardeth the shoulder-blade, from the top of the arme where it

is

fig. 1. 3.] But you must not conceiue that it taketh his Originall from the ground or soale of these bones, but from a certaine prominence or thicke line bearing out from them:

Note moreover, that in the originall this Muscle is broade (as being compounded of diuers yet continued beginnings like so many seuerall muscles) and Nervous: (tendinous saith *Columbus*) but presently becommeth fleshy and thicke, and so remaineth till by degrees it be angustated or straightned into the top or corner of the triangle, and so at length endeth into a strong Tendon which is partly fleshy, to wit, on the outside, and partly Nervous, to wit, on the inside, appearing in our dissections to ly not perfectly ouerthwart yet more then oblique. It embraceth or compasseth the middle thicknes of the arme, and is inserted in the midst thereof vnder the necke of it. [tab. 18. fig. 2. 8]

This Muscle also hath Fibres somewhat diuers, those of the fore part run obliquely downward and backward, those of the backe part run obliquely forward. And some of these do appeare to be a little implicated or entangled one within another: but the middle Fibres tend directly downward. Wherefore when the anterior Fibres are contracted, the arme is lifted vpward and forward towards the face, when the backward Fibres are contracted, then is the arme lifted backward toward the Nowle, but when the middle Fibres are equally contracted then is the arme eleuated directly vpward.

The third muscle of the arme is called *Latissimus*, that is, the broad muscle, & *Aniscliptor* the *Pruritan* muscle, [table 15, and 16, N. table 25. sheweth it separated] because it reacheth neere to the buttocks, for together with his fellow it couereth almost the whole backe, and therefore may well be called (saith *Bauhine*) *Dorsalis Maximus*, the Greatest Muscle of the backe. It ariseth with a membranous and broad beginning from the tops of the spines of the Rack-bones which are betwixt the sixt vertebra of the Chest, and the middle of the Holy-bone, [tab. 16. 5. 4] as also from the vpper part of the haunch-bone: thence ascending, when it attaineth to that part of the backe where the ribs swell out backward it becommeth more fleshy, and climbing over the lower angle of the basis of the shoulder-blade it groweth narrower, and is inserted below the vpper head of the arme lengthwise on the inside betwixt the Pectorall and the Round Muscles; his tendon being strong and short, yet broad and as it were reflected. For betwixt the tendons of those two forenamed muscles there is a distance left for this insertion, in which place also is the cavity of the arme-pit made by the Muscle and the Pectorall.

The figure of it is Triangular, for it hath three vnequall Angles, two long and one short. The sharpest is that which groweth from the Holy-bone: the next is at the Chest where the Muscle yssueth from the Ridge of the Rackes. The third is at the arme and endeth into the tendon. Moreover, this Muscle when it attaineth to the lower angle of the shoulder-blade, receiueh sometimes therefrom many fleshy Fibres, as *Galen* well obserued in his Anatomical Administrations and in the 12. Chapter of his 13. Book *de vsu partium*, which Fibres do represent a new but small Originall. *Vesalius* denies this and holdeth it not to touch the shoulder-blade, but by the interuening of Muscles which arise therefrom, and that it groweth not at all to the bone; but as he reproceth *Galen*, so *Falopius* in his Institutions reprooueth him, affirming that in all the bodies that euer he made dissection of he found this Muscle fastened to the blade.

Bauhine rendreth a reason. It groweth (saith he) with certain Fibres to the basis of the shoulder-blade, least when the blade is mooued it should ride over the muscle, for the se Fibres as it were Ligaments do hold the Muscle and the blade together. *Galen* also in the 5. Chap. of his 13. Booke *de vsu partium* saith, that by the benefit of this adhesion or cleauing the blade also is mooued downward by this third muscle. Notwithstanding, *Falopius* dares not for certaine affirme that it doth mooue the blade, but that it conferreth something to his motion he is very confident against *Vesalius*.

The Fibres also of this Muscle do differ according to the inequality of the ribs; for some are long and lesse oblique, others are short and more transuerse. Wherefore, as these fibres are contracted into themselves, the arme is more or lesse retracted downeward and depressed toward the backe, sometimes higher, sometimes lower.

The fourth Muscle is called *Rotundus maior*, almost by common consent of all Anatomists, The greater round Muscle. [tab. 10, 11, 14, 15, 16, 25. and Tab. 12. fig. 4. 0] *Platerus* also calleth it the *Longer transuerse Muscle* because it is seated obliquely on the backe side vnder the arme-hole. It is fleshy, thicke and rounder then all the rest. His Originall is but small yet continually fleshy which originall it taketh from the lower ribbe or ridge of the

Originall.

Insertion.

Vte.

The 3. muscle

Origina 1.

Insertion;

Galen redced from Vesalius.

The 4. muscle.

His name.

Table 18. sheweth in foure figures the muscles of the arme, the cubit, the wrist, the wand and the fingers of the hand.

TABVLA XVIII.



24, The second muscle of the extensors of the foure fingers. S 1,3, The fourth of the extensors of the foure fingers. V 4, The second muscle of those which extend the thumbe. Y 3, The subclavian muscle or the first muscle of the chest. Z 2,4, The fourth muscle of the extensors of the thumbe. ab 3, The higher proceffe of the shoulder at a, the lower at b. c 3, The broad ligament of the ioynt of the shoulder blade with the arme. d 3, The lower round ligament. e, The vpper round ligament. f 3, The coniunction of these two ligaments g 3, The bone of the arme sleade. h i 1,2, Portions of the muscles of the fingers from the vtter seat of the cubite propagated vnto the Tendons of the hands. I 2, Tendons in the hand reached vnto the outward seat of the forefide of the Char. 1,2,3,4,5,6, in the 2, and 4-figure: The transuerse ligament of the wrist diuided into so many small circles. n, The originall of the first muscle bending the fingers vnder the muscle noted with o. o 3, Fleasy portions of this muscle perforating the foure Tendons at rrrr. p q, The transuerse ligament of the wrist diuided and led on both sides. r r r r, 3, Foure tendons carryed vnto the fingers. s 3, the vpper monks hood or cowle muscle. t, His lower seate. u y, the coniunction of the third and fifth muscle of the cubit which Vesalius doth diuide. x 4, His insertion and a portion of the Ell sleade. Δ 1,3,4, the first muscle bending the wrist. ⊙ 1, the second bending the wrist. Δ 4, the first muscle extending the wrist. ε 2,4, the 2, extending the wrist. Π 2,3,4, the first supinator of the wand which turns the hand vpward. Ω 1,2,3, the other pronator of the wand which turns the hand downward. α 3, the insertion of the super-scapularis, or blade rider.

the blade at that part which is neare to the basis, thence passing along when it cometh to the middle of that ridge or rib it departeth from the Blade-bone, & arising a litle vpward is inserted into the vpper & inner part of the Arme with a short-but broad, strong, membranous & neruous Tendon, where also it finds the 1. muscle couched & their Tendons are alike. The vse of this Muscle (saith Bauhine) is to retract the arme downward, and so it is

contrary

A 1,2,3, The first muscle of the cubit called *Biceps*.
B B 2,3,4, The second muscle of the cubit called *Brachians*.
C 2,3,4, The third muscle of the cubit called *Longus* or a part thereof.
D 4, The fourth muscle of the cubit or the short muscle.
E 1,2, The muscle in the palme of the hand.
F 3, The first muscle of those which bend the foure fingers.
G 3, A portion of the second of those which bend the foure fingers.
H 3, The first of those which bend the thumbe.
I 3, The clauicle or collar bone removed from his owne place.
K 1, The collar bone in his owne place.
L 1, The pectorall muscle or the first of the Arme.
α β γ, His circumscription and originall.
δ ε 1, and 2, His insertion.
μ 1,2, and 4, The muscle called *Deltoides* or the second muscle of the arme.
ζ η, His broader originall.
θ, His insertion.
ι κ, The muscle called *Deltoides* separated and the inner part of it.
O 4, The greater round muscle, or the fourth muscle of the arme.
P 4, The lower *Super-scapularis*, or blade rider, or the fourth muscle of the arme.
p 4, The lower. The first of those muscles which extend the 4. fingers.

contrary to the second muscle called *Deltoides*. *Galen* reckons it among the *Turners* of the arme, for (saith he) it turneth the arme outward: *Vesalius* reprehends him and sayeth that it applyeth the arme directly to the backe. But *Archangelus* beside that direct motion, ascribeth vnto it an outward motion and a little inward. *Laurentius* would haue his motion to be onely oblique.

At the lower part of this Muscle or at the lower rib or ridge of the blade we finde a distinct portion implanted with a neruous termination neare the insertion of the 5. muscle which *Falopius* maketh the eight muscle of the arme, which (saith he) is manifestly separated from all the rest, as I haue found in all my Dissections, and I wonder much (sayeth he) that our late Anatomists haue ouer-skippt this muscle, which is of great moment as being together with the seauenth the authour of the same motion, especially because *Galen* obserued it in Apes in the 18. chapter of his Booke *de dissect. muscul.* and in the first chapter of the 5. Booke of his Anatomicall Administrations.

The first Muscle of the Arme is called *Superfascularis inferior*, the lower Blade-rider, [tab. 15. 16. 25. P. tab. 18. fig. 4. P.] It couereth all the outward and gibbous part of the blade which is vnder his spine and beareth the forme thereof. It ariseth fleshy from the Basis of the blade below the spine, becomming narrow as the blade-bone groweth narrow, and is inserted obscurely semicircular wise to the outside of the Ligament of the arme which holdeth the ioynt.

The vse of it is (saith *Bauhine*) to leade the arme in compasse outward, *Archangelus* addeth vpward also, *Laurentius* saith it retracteth it backward.

The sixt Muscle called *Superfascularis superior* or the vpper Blade-rider, is also called *Rundus minor* the Lesser round Muscle. [tab. 10. 11. 15. 16. 25. Q.] It is seated about the Arme-hole and filleth all the cavity which is betwixt the vpper ribbe or ridge of the blade and the spine of the same; from which it ariseth fleshy, long and hauing long fibres, for it proceedeth from that Basis of the blade-bone to which it groweth very strongly, and when it attayneth to the vpper part of the neck of the Blade, it runneth vnder a transuerse Ligament which coupleth the arme to the inner proceffe of the blade, and with a broad and strong Tendon riding ouer the ioynt is obliquely inserted to the Ligament thereof.

The vse of this Muscle saith *Bauhine* is the same with that which went before and which followeth after, *Archangelus* sayth it leadeh the Arme vpward and backward, *Laurentius* backward onely, *Vesalius* doeth not thinke that *Galen* makes any mention of this Muscle, vnlesse haply it be reckoned among the Heauers of the Arme, for none of his descriptions agree thereto, although hee make light mention of a muscle riding ouer the vpper rib of the blade.

The seauenth muscle called *Subfascularis* the Blade-lurker, or *Inmersus* the drowned Muscle, [Tab. 7. R.] is seated betwixt the Blade-bone and the ribs. Very fleshy it is and continuall with the former on the vpper side, occupying the inner hollow part of the Blade-bone, from whence it ariseth. It is like the Blade triangular, straitned by degrees at the inside of the ioynt, and with a broad Tendon is Semicircularly inserted into the inside of the arme, (*Laurentius* sayth into the necke and head of the arme) so that the Tendons of the 3. muscles which leade the arme about do orbicularly incompasse the whole ligament of the ioynt.

His vse is to leade about the Arme inward, *Galen* in the 18. chapter of his Booke *de dissect. muscul.* sayeth that it circumuerteth the head of the arme backward: *Archangelus* that it moued the arme vpward and inward, *Laurentius* that this together with the lesser round muscle and that which is called *Infra spinatus* doe moue the arme semicircularly backward, for (sayth he) a perfect circular motion the arme hath not from any peculiar muscle, but by the successive working of them all, for that which is circular is compounded of all the right and all the oblique.

That notable musculous portion arising from the proceffe of the Blade-bone which is like an anchor, and inserted into the arme, *Arantius* and *Placentinus* doe esteeme to be a muscle of the arme; others account it for the first muscle of the cubit. His vse say they is to leade the arme to the proceffe of the Blade-bone, and indeede the motions of the arme and cubit are neare of kin, for when the cubit is bent in the Elbow, it is most what necessary that the arme also should bee lifted vp, as we may obserue in our selues; and so much of the muscles of the Arme.

CHAP. XXV.

Of the Muscles of the Cubit.

The bones of
the Cubite.

THe Cubit which is the second part of the Hande in the large acceptation, consisteth of two bones, the first is called *Cubitus* or *Vlna*, the Cubit or the Ell, and we retaineth that name when we call the place where it is bent the *Elbow*. The second bone is called *Radius* or the *Wand*. These bones haue diuers motions, & therefore the Muscles of the Ell and the Wand are diuers. The Cubit or Ell hath two motions, for it is bent and extended directly. *Galen* attributeth also to it an oblique motion, which *Columbus* saith is nearer to be found in a man: the *Radius* or wand being mooued turnes the hand vpward and downeward: First we will speake of the motions of the Cubit which are performed by the helpe of foure Muscles, some say five, and these are called the muscles of the Cubit, not because they are seated in the Cubit, but because they mooue it. For they arise from the arme and the blade, and take vp the roome along the arme; the two *Benders*, the inside or fore-side, and the two or three extenders the outside or the backside. But these Muscles which are seated in the cubit it selfe do serue to mooue cyther the Wand, or the Wrist, or the fingers.

The 1 Bender

The first *Bender* is called *Biceps* [tab. 18. fig. 1, 2, 3, and tab. 19. fig. 1, and 2, A] or the double-headed muscle, because it hath a double beginning and these very strong standing off one from another to giue way to the Nerue of the arme and the insertion of the muscles of the same. These originals doe arise from the shoulder-blade, but are covered by the second muscle of the arme called *Deltoides*. [tab. 18. fig. 1 M, at fig. 3, N, they are vncouered]

The situation of this Muscle is on the inside of the arme, and in those bodies that are fleshy or brawny it may be perceiued vnder the skin before the dissection. Of these two originals the one is outward [tab. 19. fig. 1, n] which is neruous and round, arising out of the vpper brow of the cup of the shoulder-blade, and is deriued vnder the Ligaments of the ioynt of the arme, and aboue the head of the same through a fissure or cleft made of purpose for this vse.

The other originall [tab. 19. fig. 1, o] is partly Neruous, partly fleshy, broader also then the other arising from the proesse of the blade-bone which is like vnto an Anchor, and led aboue the head of the arme, a little vnder which head it is vnited with the former [tab. 19. fig. 1, and 2, p] and so they make one thicke, strong liuid muscle round and furnished with right fibres.

A fleshy portion
accounted
for a particular
muscle.

A fleshy portion of this muscle is inserted into the middle of the Hand, where the bone hath a private asperity by which it is lift vp. This portion (sayth *Columbus*) to a man that is not sharpe sighted seemeth a distinct muscle drawing the arme to the brest, of which portion also *Vesalius* and *Laurentius* haue made mention, but not *Falopius* or *Archangelus*, but *Arantius* somewhat boldly propoundeth it for the eight muscle of the arme: and indeede departing from the arme and climbing ouer to another muscle it beareth the forme of a round and fleshy muscle, and a little aboue the ioynt of the cubit becomming more sinnewy it endeth into a strong, thicke, round and neruous Tendon, and being moderately dilated is inserted into an inward eminence and protuberation of the *Radius* or wand, created onely for the insertion thereof. It groweth also somewhat to the ligament of the ioynt. [tab. 19. fig. 1, g] This Muscle as also the second hath right fibres, wherefore with the second it benderth the cubit straight inward.

The 2 Bender

The second *Bender* is called *Brachialis* the muscle of the arme [tab. 18. fig. 2, 3, 4. tab. 19. fig. 1, 2, 3 B]. It lyeth vnder the former, is shorter than it and wholly fleshy, and embraceth very closely the lower and middle part of the length of the arme vnto which also it groweth. It ariseth from the bone of the arme in that place where the Muscles of the arme are inserted about the middle of the length thereof on the outside. His beginning is fleshy and twofold, [tab. 21. fig. 2, 3, V] and in the middle resembleth an obtuse angle. Presently after it becometh thicker and groweth strongly to the arme, and descending downeward fleshily couereth the fore-side of the Elbow representing a little hillocke, and is strangely infixed or inserted larger and more fleshy into the forepart of the Cubit or Ell, and the *Radius* or Wand, and the Ligament of the ioynt. [tab. 21. fig. 2, G fig. 3, o] to bend the cubit in a streight line.

The third.

The third muscle of the cubit or the first *Extender* called also the long muscle [tab. 28. fig. 2, 3, 4. tab. 19. fig. 1, 2, 3. and in the other figures at C] runneth fleshy and with right fibres through the backside of the arme. It ariseth with a strong and broad originall, partly neruous and partly fleshy from the lower rib of the blade bone a little vnder his necke, where it hath

The insertion of the
of the fingers.
1, 3, portions of the
section, whereof d
ing to the Tendons
bending the Finger
1, the corner of
Muscles of the blade
red in the reme pre
1, the higher proce
the shoulder.
2, the insertion of
2, the lower proce
1, 2, the outward
Biceps.
1, 2, his neruous he
1, 2, the coition of
1, 2, the tendons of
1, 2, A part of the S
the hand vpward
the cubit.
1, 2, his breade tend
wand.
1, 2, the beginning of
Fingers.
1, 2, the Biceps or
hangeth vpon the
B 1, 2, 3, the 2 m
C 1, 2, 3, the 3 m
E 1, the muscle of
tendon is at 4.
F 1, 2, the first mov
ing downe in the
G 1, 2, the second
hanging in the
H 1, 2, the muscles
in the 4. Figure.
1, 2, 4, the first of the
dependeth from h
K 1, 2, the second b
L 1, 2, the 3, bend
N 1, the muscle
third muscle call
muscle of the arm
the Vlna or Ell with
3, 4, the wand bare
1, 2, 3, the upper 1, 2
shoulder blade. 5 the
third extending mu
4, the tendons of the
doe abide, 1, 2, the
muscle inserted with
1, 2, the muscles of
rule or the worme
in the bender of the
muscle called *Leuor*
the wrist. 1 The
wand, in the 3. Figure
1, 2, 3, 4, The round
the thumb. * a li
hath a particular
groweth very
[tab. 21. fig. 1, A] b
downe with to giue

C, The insertion of the wormy muscle into the first bone of the fingers.

d e f 3, portions of the tendons cut off neare vnto their insertion, whereof d is the insertion of the Muscle growing to the Tendons, e the insertion of the first muscle bending the Fingers, and f of the second.

b 2, the corner of the shoulder-blade wherein the foure Muscles of the blade called *Leuator* or the heauer, noted in the tenne precedent tables, is inserted.

i 2, the higher proceffe of the shoulder or to the top of the shoulder.

k 2, the insertion of the vpper blade rider.

l 2, the lower proceffe of the shoulder blade.

n 1, 2, the outward neruous head of the muscle called *Biceps*.

o 1, 2, his neruous head.

p 1, 2, the coition or meeting of these two nerues.

q 1, 2, the tendons of this muscle.

r 2, A part of the *Supinator* or the muscle which bendeth the hand vpwatd where it goeth from the arme vnto the cubit.

s 2, his broad tendon inserted into the appendix of the wand.

t 2, the beginning of the second muscle bending the foure Fingers.

A 1, 2, the *Biceps* or the first muscle of the cubit which hangeth vpon the fourth from his insertion.

B 1, 2, 3, the 2 muscle of the cubit called *Brachians*.

C 1, 2, 3, the 3. muscle of the cubit called *longus*.

E 1, the muscle of the palme of the hand whose broad tendon is at u.

F 1, 2, the first muscle bending the foure Fingers hanging downe in the second Figure.

G 1, 4, the second muscle bending the foure Fingers hanging in the fourth Figure, & sheweth his tendons.

H H 2, the muscles called *Lumbricales*, their insertion at e in the 4. Figure.

f 2, 4, the first of those that bend the thumbe, in the 4. it dependeth from his insertion, and his tendon is at e.

K 1, 2, the second bender of the thumbe.

L 2, 4, the 3. bender of the thumbe.

N 1, the muscle *Deltoideus* inuerted. the vpper N in the third muscle called *Latissimus*, the tendon of the third muscle of the arme. The lower N in the 3. & 4. Figure;

the *Vlna* or Ell without flesh. O, the vpper in the third Figure, the fourth greater round muscle of the arme. o the lower

3, 4, the wand bared. Q 3, the vpper Blade rider whose insertion is at f, 2, K. R, 3, the Blade-lurker whose insertion is

at s. S, the vpper 1, the lesser Saw, whos amplitude whereby it groweth to the ribs. T, the place where it groweth to the

shoulder blade. S the lower 1, 2, the thicke muscle of the little Finger, or the fourth muscle of the extenders. X 1, the

third extending muscle of the thumbe. X 2, the place where the muscle noted with G is diuided into foure fleshy parts:

Y 4, the tendons of the second muscle bending the foure Fingers. y 2, the place where the tendons of the second muscle

doe abide. A 2, the place where the tendons of the first muscle remaine. s 2, the tendons of the first muscle bending the

thumbe inuerted with the muscles in the hand. n 1, 1, the amplitude of the greater Saw whereby it is ioyned to the ribs.

n 2, the muscles of the Fingers growing to the foure tendons of the second muscle in the hand which are called *Lumbricales*

or the worme muscle. i 3, where it groweth to the angle of the shoulderblade, A 1, the beginning and the insertion

of the bender of the wrist. u 1, the tendon of the muscle of the palme of the hand. V 1, the transuerse ligament. T 1, the

muscle called *Ieterossum* or the slender muscle of the little Finger of the palme of the hand. A 1, The first muscle bending

the wrist. O 1 The second muscle bending the wrist here hanging downe. n 1, 2, 3, the first *Supinator* of the *Radius* or

wand, in the 3. Figure hanging from his implantation. q 3, 4, the first *pronator* of the wand or the square muscle.

n 1, 2, 3, 4, The round *Pronator* of the wand. Character 1, 2, 3, in the fourth Figure, the fourth, 5. and 6. muscles bending

the thumbe. * a ligament going betweene the Ell and the Wand.

hath a particularosome or cavity to touch it selfe in, and descending directly downward, it groweth very fleshy to the inside of the arme, or rather it is increased with a fleshy portion [tab. 21. fig. 1, A] bred out of the arme as it were with another original, which is mixed therewith to giue it strength: with which portion being augmented it descendeth directly

Aaaa 2

downe-

Table 19 sheweth the Muscle of the Cubit, the Wand and the Fingers.

TABVL XIX.

FIG. 1.



Augmentation

downward, (that fleshy portion euen to his end growing to the arme) and becomming partly neruous on the outside, partly fleshy on the inside, is inserted into the inner side of the backward proceffe of the Cubit called *Olecranon*; *Archangelus* saith it is inserted into the *exterior* part of the *Radius* where it hath a cauity insculped for it.

Insertion and use.

The use of this muscle is together with that that followeth, directly to extend the Cubit; *Archangelus* addeth that it lifteth it also vpward.

The fourth.

His originall.

Progresse.

Insertion.

Fibres & use.

Munkies.

The actions of the muscles of the cubit.

The fourth muscle or the second *extender* called also the *short* muscle. [Tab. 18, fig. 4. Tab. 20, fig. 1, and 2, D] occupieth the outward part of the back-side of the arme. It ariseth with a neruous originall, (and double saith *Columbus*) from the back-side of the neck of the arme and becomming fleshy before it hath overcome the middest of the length of the arme it is so mingled with the former that euen vnto the insertion it can by no means bee separated therefrom, so that it may seeme to be but one muscle or one body compacted of three muscles, whereas notwithstanding in truth they are two; for this fourth muscle is very strongly inserted [tab. 18, fig. 4, x tab. 20, fig. 1, and 2, x] into the outside of the posterior proceffe of the Cubit, where it is partly fleshy, partly neruous, especially about the point whercon wee leane with ourelbowes, which sinew haply is the reason why at sometimes leaning hard vpon the pitch of the elbow, we find a kind of benumbednes or painefull sensation like the sleepines of the legge to runne along our arme both vpward and downward.

This fourth muscle as the third, hath right fibres, wherefore also it extendeth or stretcheth out the Cubit directly, *Archangelus* addeth also downward. But in dogges and Munkies and other Creatures which rest themselues much vpon their forefeete, there are three very conspicuous extending muscles, beside one very small, found in Munkies (but by *Galen* pretermitted saith *Vesalius*) which runneth from the shoulder-blade to the Cubit or Ell.

So then in these muscles of the Cubit the primary action is euident, which is contraction, & the secondary which is relaxation: when the *bending* muscles are contracted, the *extenders* are relaxed, that so the Cubit might bee inflected with more ease: againe, when the *extenders* are contracted, the *benders* are relaxed that the Cubit might be better stretched out, and both these actions are performed by right motion. By accident also they follow the motion of the arme. Moreouer, the Cubit is moued sidelong and round.

CHAP. XXVI.

Of the Muscles of the Radius or Wand.

The motions of the Radius double.



THE motion of the *Radius* or *Wand* is double, for either it is moued *per se*, of it selfe (the Cubit or Ell being vnmoued) by reason of the ioynt eyther about with the arme, or below with the wrist, or both about and below with the articulation of the Ell; and so the whole hand is mooued eyther downward or vpward, (for the whole hand being sustained almost alone by the *Radius*, hath one and the same motion, and therefore is turned vpward by the assistance of two externall muscles; and downward by two internall, by which also it is turned about.) Or it is mooued by accident with the Ell in a right line when the whole Cubit is bent and extended. There are therefore foure muscles of the *Radius*, two called *Supinators* which turne the palme of the hand vpward, and two call *Pronators* which turne the palme downward.

The first Supinator.

The first *Supinator* which is the second of the *Wand* according to *Vesalius* (who calleth it also the *exterior*) *Pallopius* and *Platerius*, is also by *Laurentius* called *Supinator longior*, [tab. 18, fig. 1, 2, 3, and tab. 20, fig. 1, 2, 4, n] because in respect of his belly it is the longest of all those muscles which run along the Cubit. It ariseth fleshy from the edge of the outward and vpper protuberation of the arme, [tab. 19, fig. 2, f. tab. 20, fig. 4, a] afterward being dilated it is bended vpon the *Wand*, and is inserted, growing broade at his Tendon, into the membranous appendix of the *Radius* toward the inside. [tab. 19, Fig. 2, f. and tab. 20, Fig. 4, b] This Muscle ouer-turnes the lower part of the *Wand*, and so lifts the palme of the hand vpward.

The second.

The second *supinator* which is the shorter [tab. 20, Fig. 1, 3, 4. and tab. 21, Fig. 1, 2] ariseth fleshy. *Platerius* and *Archangelus* say from a strong Ligament which bindeth the cubit

A, 1, 2. A part of the muscle called *Biceps*, or the double-headed muscle.

B, 1, 2, 4. The higher and outward part of the muscle called *Brachialis*.

C, 1, 2, 4. the muscle extending the Cubite from the lower part of the shoulder-blade, others call it the fifth muscle of the Cubit.

D, 1, 2. The short muscle extending the cubit arising from the neck of the arme.

E, 1. The second or the two-horned muscle bending the wrist.

M, 1, 2, 3. The muscle *Deltoides* or the second of the arme.

N, 3, 4. The Ell without flesh.

O, 1, 2. The fourth muscle of the arme called *Rotundus maior*.

O 3, 4. The Wand bare a great way.

P 1, 2, 3. The lower blade rider or the fifth muscle of the arme.

The lower P in the 1 and 2 figure. the first extender of the foure fingers, in the second figure hanging downe, whose originall is at a and tendons at b.

Q 1, 2. the 2 muscle extending the foure fingers; in the 2 Figure hanging downe.

R 2, 3. the third extender of the forefingers in the third Figure hanging downe clouen into 2 parts at op in the 2 Figure.

S, 1, the 4 muscles extending the fore fingers.

T, 1, the vpper, the first muscle extending the thumb.

V, 2, 3. the 2 extending the thumb.

X, 3. The originall of the 3 muscle extending the wrist.

Z, 1, 2, 3, 4. The 4 extender of the thumb.

a, b, 1, 2. The originall of the first extender of the foure Fingers from the protuberation of the arme at a and his tendons at b.

a 4. The originall of the shorter supinator of the

Wand. C 1, the originall of the first extender of the wrist from the vpper protuberation of the arme. C 1, Another part of the long extender of the cubit. d 1, His insertion at the little Finger. e 2. the spine of the blade and the top of the shoulder. f, g, the originall of the Cowle muscle in the hinder part from the spine of the blade. h 2, His insertion. i 2, the membranous Ligament of the Wand, tying the vpper part of the arme. i, k, l, m, n, 2, 3. The vpper part of the second muscle extending the thumb marked with V. inserted into the bone of the wrist at k, l, the lower part divided into two at l, the one vnder the wrist bone that sustaineth the thumb at m, the other inserted into the thumb at n. op 2, The thirde extending muscle noted with R cut into two parts. q 4, the backe of the shoulderblade bare. r 2, the originall of the second extender of the wrist. s, t, 3. the originall of his horned tendon, the insertion. t, x, 1, 2, A place of the Ell without flesh. Δ 1, 2, the first bender of the wrist. Δ 1, 2, the first extender of the wrist. m in the 2 Figure hanging, whose originall is at e and inserted at d. π 1, 2, 4. the first supinator of the wand whose beginning is at e, insertion at β in the 4 Figure. Σ 2, 3, 4. the shorter supinator of the Radius, whose beginning at e his insertion at γ. Ξ 2, 3, 4. the second Muscle extending the wrist. α, β 4, the beginning of the first supinator of the wand from the arme at α, whose insertion at β. γ 4. the insertion of the shorter supinator of the wand. δ, t 4. A place where certaine bofomes are prepared for the transporting of the tendons, and containing a gristle of that place. ζ, 4. Ligaments ioyning the bones of the wrist together. * 3, 4. A Ligament in the middest betwixt the Ell and the Wand.

bit to the arme and from the vpper part of the Radius. *Banvine* from the ioynt which articulath the cubit to the arme, and from the backward proceffe of the Ell [tab. 20. fig. 4. 4] which is called *Olecranon*: from thence it paceth obliquely and is implanted almost into the middest of the wand, to which also it adhereth [tab. 20. fig. 4. 7] and it is on the outside membranous and on the inside fleshy. This muscle turneth the vpper parte of the wand obliquely outward and turneth vp the backpart of the hand.

The first *Pronator* which *Vesalius*, *Fallopianus*, and *Platerus* reckon for the first of the Wand, is called also by *Laurentius*, *Quadratus*, [tab. 19. fig. 3, 4. and tab. 21. fig. 3, 4] because it ariseth fleshy, broad and square, from the lower and inner part of the Ell neare the wrist, and lying ouerthwart on the foreside is inserted with a membranous tendon, *Columbus* and *Archangelus*

The first *Pronator*.

Table 21. Sheweth some muscles of the Cubit, the Wand, the thumb, and those we call interossei or bone-Muscles.

TABVLA XXI.



q 1, 2. The shoulder-blade bare, and in the second figure is his interior part.

b 1, 2, 3. The second muscle of the Cubit called *Brachialis*, whose double originall in the third figure is noted with *r* and his insertion at *o*.

C 1, Muscles extending the cubit which are accounted by *Vesalius* three, The third at *i* the fist at *n* & the fourth at *λ*.

G 2. The insertion of the muscle called *Brachialis*.

N 1, 2, 3. The Ell bared from the flesh.

O 1, 2, 3, the *Radius* also with flesh.

Q 1. the vpper bladderider inuerted.

R 2, the same *super scapularis* hanging downe.

X 2, Two muscles bending the second ioynt of the thumbe.

Y 2, 3, One of the muscles called *Interossei* applied to the roote of the second ioynt of the thumbe, but in the third figure are the *Interossei* in the palme of the hand, which fill the distances betwixt the bones of the Wrist.

Z 1, The short *Supinator* of the Wand bending downward.

9 3, the square muscle of the Wand bending down.

Ω 1, 2. the round muscle of the Wand called *Pronator*, whose insertion is noted with *G*. This in the second figure is hung from his insertion.

θ 1, the bone of the arme altogether without flesh.

ι 1, 2, 3, The first muscle of the cubit at *i*, the fourth at *λ*, the fist at *n*: or the three extending muscles.

μ 1, The insertion of the muscle of the Wand called *Pronator* at *Ω*.

ν 1, 2, 3, *V*, the originall of the second muscle of the arme called *Brachialis*, on either side his insertion in the second figure at *G*, in the third at *O*, 1, 2, 3.

char. 1, The fourth fist and fist benders of the thumbe, * Heere a ligament commeth betwene the Ell and the Wand.

His fibre.

Figure.

Vic.

The second
Pronator.
His originall
Progreffe.

Insertion.

say fleshy) into the inner & lower part of the Wand. His fibres are transuerse and clime vp ouertwhart from the Ell vnto the Wand. It is a large muscle, and incompaseth all that part of the Ell and the Wand which lies directly against the inside of the Cubit. It is square and so long as in the inner Region of the whole Cubit made of the Ell and the Wand. It is also euery way fleshy, and in the middle thicke and bunching, seruing instead of a soft pillow vnder the tendons that runne vnto the fingers. This muscle drawing the lower part of the Wand which is next vnto the wrist inwarde, beareth downe the Wand and the hand fastened thereto into a prone position.

The second *Pronator* which is the third muscle of the Wand according to *Vesalius*, *Fallopianus* and *Platerus*, is by *Laurentius* called *Rotundus*. [tab. 18, fig. 1, 2, 3, and tab. 19, fig. 1, 2, 3, 4. and tab. 21, fig. 1, 2, 3.] It ariseth fleshy from the inner protuberation of the arme and the inner side of the Ell where it is articulated to the arme, or as *Fallopianus* hath it, from the inner ligament of that ioynt: thence it climeth obliquely ouer the inside of the Wand and is implanted with a fleshy insertion about the middle thereof, [tab. 20, fig. 4, 5] from his insertion it runneth out neruous to the very middest of the Wand, and is infixed very strongly with a neruous Tendon to a certaine roughnes that is in the vpper part thereof [tab. 21, fig. 1, 4] As often as this muscle is contracted it leadeth the vpper part of the wand inwarde, and so wresteth the Wand and the whole Hand into a proane and downward position.

CHAP. XXI.

An enumeration of the Muscles of the Hand, properly so called.

Alen considering the admirable frame & structure of the Hand, because it is as he saith the *Instrument of Instruments*, intreateth of it in his first Bookes *de usu partium*. *Columbus* in the last place, because (saith he) the wonderfull and miraculous frame thereof might remaine infixed in our memories; but we will discourse of the Muscles thereof in this place, because we will follow the order of dissection.

Seeing

Seeing therefore that the proper action of the Hand is Apprehension, and Apprehension a Motion depending vpon our will, it was also necessary that the hand should haue muscles which are the instruments of voluntary motion whereby it might bee mooued altogether and euery finger apart.

The muscles
of the hand
double.

The muscles therefore which moue the hand are of two sorts, some haue the guide of the motion of the whole Hand, others moue the Fingers onely. The former are likewise of two sorts; for some doe either bend or extend the Wrist and consequently the Hand with the same motion, others mouing the *Radius* or Wand do together also turne the Hand downward or vpward.

These Muscles are seated vpon the cubit either on the outside or on the inside. Hither also may we referre that Muscle that moueth the skin which is in the palme of the Hand. Those that moue the Fingers doe either bend or extend them or moue them sidelong, that is ioyning them together or parting them asunder.

But because the thumbe (which is called *Pollex*, for that it is æquipollent or æquivalent to the whole Hand) hath in his bending and extending something peculiar to himselfe differing from the same motions in the other foure Fingers, therefore it hath his peculiar Muscles, as also the rest of the Fingers haue theirs, whereof some are seated in the cubit, others in the After-wrist and others in the ball or palme of the Hand.

The reasons
of the motions
from the
articulations.

Againe, because the articulation is diuers in the first ioynts of the five Fingers and is the second of the Thumbe, from that it is in the second and third ioynts of the foure Fingers and the third of the thumbe, because the latter are ioynd by *ginglymos*, the vpper bone receiuing into his bosome the protuberation or swelling of the lower, and the lower bone into his cavity the heads of the vpper: hence it cometh to passe that their motion is onely simple, absolved by extention and flexion without any inclination to either side: but the first bones of the foure fingers and the first of the thumbe being fastned by a firme articulation to the bones with which they are sustayned, are not onely bent and extended, but inclined also to the sides as they are led to-ward or fro-ward the thumbe.

I could busie my selfe and you too in setting downe each Authors diuision of the muscles of the Hand, for euery one almost differs from another, but because the History that followeth dependeth most what vpon *Banbines* relation, therefore wee will remit him that is desirous to know each mans minde vnto their proper discourses, and content our selues with *Banbines* alone.

In the whole summe therefore the Muscles which moue the Hand are forty; foure of the wrist, foure of the wand, of the palme of the hand three sometimes foure, and 29. of the fingers.

40. muscles of
the hand.
How seated.

Some of these Muscles are seated in the cubit because it was very necessary they should be large, and their tendons onely are transmitted vnto the fingers. For if they had beene placed in the Hand they must needs haue increased the bulke thereof to that quantity which would haue beene preiudicall to the vse of so excellent an organ. Notwithstanding some are situated in the Hand.

Of these Muscles there are nine benders: two bend the foure fingers and seauen the Thumbe. The extenders are 20. sixteene extend the 4. fingers, in which number are those foure called *Lumbricales* the Wormy muscles, and those eight called *Interossei*, because they lurke betweene the bones. The other foure extenders doe serue the thumbe which they doe either simply extend or leade to the fingers or from the fingers: the tendons of which foure muscles as *Galen* obserueth in the 17 chapter of his sixt Booke *de vsu partium*, are infixed in the ioynt of the bone that is to be moued. But because in dissection wee meete first with the muscle which is called *Palmaris*, therefore in the first place we will intreat of it.

The vse of the
40. muscles.

CHAP. XXVIII.

Of the Muscle of the Palme, and 2. or 3. other issuing from the fleshy Membrane.



HE Muscle of the palme so called by *Laurentius* and *Banbines* lyeth vpon all the interior Muscles of the Hand. [tab. 22 fig. 1, 2, tab. 23, fig. 1, E] It is seated in the cubit and is neruous and round, arising with a neruous beginning from the sharpe poynt of the inner protuberation of the Arme; leaneth vpon and groweth to the mid-

- His originall.** middest of two muscles which bend the wrist, [tab. 22. fig. 1, ΔΘ] and proceede out of the same protuberation with it. Presently after his originall it becommeth fleshy, yet is the belly of it but small, and before it attaine vnto the middle of the cubit it passeth somewhat obliquely, afterward it is againe attenuated and groweth small or slender and determineth into a round, narrow, and long tendon [tab. 23. fig. 1. μ] which riding ouer the inner Ligament of the wrist, passeth vnder the skinne, and his tendon in the ball or palme of the Hand is dilated, attenuated and groweth to the skinne, yet so that it lyeth not vnder the part of the skin which couereth the muscles in the hillocke of the thumbe [tab. 22. fig. 3, vnder p] and those which leade the little finger from the rest. [tab. 22. fig. 1, and 3, S] Finally it is ioyned with so strong & fibrous ties to the rootes of the Fingers, that although there be a certaine fat, or substance like vnto it, (of which *Galen* maketh mention) comming betweene, yet you can scarce separate the skin of the hand from the sinewy thinnesse of this Tendon.
- Progresse.**
- Insertion.**
- Vse.** The vse of this muscle is firmly to corrugate or contract the skinne of the palme when we would hold any thing fast, for by that meanes the skinne becommeth immouable, which if it should mooue, we could not hold a thing so steddily or so safely. Haply also this Tendon is the cause why the skin of the palme hath more exact sense then the skin of the whole body: not that so quicke sense is giuen to the hand by this Tendon, but because of the foure nerues which run vnto the foure fingers.

[Table 22. is the same with Table 18, Folio 778.]

Fallopins his
observation.

Fallopins thrice or foure times found this muscle arising out of the same place in each arme double, whereof one did end into a broad Tendon, the other was inserted into the transuerse ligament of the wrist: on the contrary *Vesalius* saith that he found more then once the fleshy part thereof wanting, and then the broad Tendon was made of a portion of those Tendons that bend the wrist, [tab. 22. fig. 1, ΔΘ] before they ascend vnto the same. Sometimes also (saith *Bauhine*) the broad Tendon is produced from an internall transuerse ligament which runneth ouer the Tendons of the wrist, which also *Columbus* obserued in the dissection of some theeces.

A musculous
substance a-
rising from
the fleshy
pannicle.
The formes
of it.
The fibres.

Beside this muscle of the palme in the beginning of the inside of the hand at the lower part of the hillocke called by some *Mons Luna*, by some *Mons Martis*, by others *Veneris*, but we wil call it the Mountaine of the Moone, where the eight bone of the wrist is seated, there is found a certaine flesh. It proceedeth out of the fleshy pannicle, or from the membrane of that muscle which frameth the foresaid Mountaine of the Moone. This flesh carrieth the forme sometimes of two, seldome of three slender and short muscles. It hath transuerse fibres and runneth to the middle and inner part of the ball of the hand, and is implanted at the broad Tendon of the palme muscle, where it receiueth a complication with the fleshy pannicle which in that place is fatty. The vse of this flesh is in great contractions of the palme to draw the Mountaine of the Moone to the middle of the hand, when we would make it as hollow as we can, or else to binde in the two hillocks at the thumbe and the little finger for the same vse. Of this muscle (if so you will call it) none of the Ancients made mention, but it was first found by *Iohannes Baptista Conanus* and first described in print by *Valuerda* who yet mistaketh the vse, for he saith it was made for extension.

His vse.

CHAP. XXIX.

Of the substance which commeth betweene the skinne of the palme and
of the fingers and their Tendons.



Et wixt the Tendon and skinne of the Palme and the inner side of the fingers there appeareth a certaine fleshy substance like vnto fat, of which it shall not bee amisse a little to discourse. Although the whitish colour it hath and the hardnes do more resemble fat then flesh, yet wee conceiue that it may more fitly bee referred to a kinde of flesh, as well because it is full of sinewy fibres, as also because there are many small and threddy Veines disseminated there-through. Add also that though a man be neuer so much extenuated or consumed, yet there alwaies

remains

remaines some part of this substance, whereupon it is that *Galen* calls it flesh, and the *Arabians* thought it to be a kinde of simple flesh different from the body of a muscle. It may be objected, how then comes it to be so hard? I answer, by the contraction of the bones and of the Nervous parts which lie vpon it, and therefore it is like the fat which ioyneth vpon the ioynts of the bones. The vse of this substance is to be as it were a pillow or bed whereon the many propagations of sinews might lie soft which were derived from greater Nerves to make the hand of exquisite sense. Such a substance also is found betwixt the Tendons that bend the fingers & their skin, least when we are constrained rudely, to take holde of any hard substance the tendons should be pressed or otherwise offended, for which cause also it is very plentifull vnder the skin of the soale of the foote, yet it is to be noted that there is lesse store of it about the Ioynts least it should hinder their Motion, especially when they bend into an acute Angle.

That it is flesh
not Fat.

In like manner in the sides of the Fingers, there is some of this flesh to fill vp the spaces betwixt the Ioynts which otherwise would haue bene hollow, because the side knuckles at each bone doth stand somewhat out from the length of the bone, which equalitie was not onely made for ornament but rather and more especially to make the Hande as we say thigh, that is, able to holde a liquid substance when wee gather our fingers toward the Palme to make *Diogenes* his cup. Finally, this substance is very profitable in the toppes of the fingers for better apprehension, for if nothing had bene placed vpon the extremities of the bones which might yeelde a little when wee offer to take holde; surely the bones would haue bene in danger of breaking, and beside wee could not haue gotten holde of many things which now we do by helpe of this substance and the Naailes.

In what part
of the Finger
this substance
is.

CHAP. XXX.

Of the Muscles which bend and extend the fore fingers.

WE said before that there were two Muscles which did bend the forefingers & 16 that did extend them. The first Bender [*tab. 22. Fig. 4. F*] ariseth with a round beginning and large, mixed of a fleshy and Nervous substance, from the internall protuberation of the arme vnder the heads of the Palme-muscle [*tab. 22. Fig. 1. and 2. E*] and those two which bend the Wrist. [*tab. 22. fig. 1. Δ, ○*] Afterward becomming broader, it passeth through the middle and anterior parts of the Ell and the Wand, and becommeth fleshy and round, yet before it attaine vnto the roote of the Wrist, his Venter or Belly is angustated or straightned, [*tab. 22. fig. 1. ϑ*] and diuided into foure fleshy parts, all which doe determine into tendons exquisitely nervous and transparant: and being together involed in one common, thin and mucous membrane; for their more safe progression doe passe along vnder the annular or round Ligament [*tab. 23. fig. 1. V*] which is seated ouerthwart the wrist; & at the second bone of the forefingers nere the middest of the Ioynt are diuided with a long Section or slit through which the tendons of the next muscle to bee described (which lyeth vnder them) which were to reach vnto the third Ioynt, are transmitted. There they become broader that they might moue more easily and apprehend or take holde the better, and a little after the diuision or section they are inserted into the second bones of the foure Fingers. And truly this progresse and insertion of these muscles is an admirable and strange worke of Nature: for they are so seuered, that the fingers in their motion might orderly follow one another, and each of them alone bend inward.

The 1 Bender
of the forefin-
gers.

An admirable
worke of Na-
ture.

Moreover, as they creepe vp the first bones of the Fingers they are rowled about againe with a transuerse Ligament, which Ligament ariseth out of the inner part of the bone and maketh a kinde of Trough, wherein the tendon of this first bending muscle, together with that of the second muscle vnder it, might securely passe along the length of the Finger and holdeth it fast least it should depart from his owne seate and so decline from his owne finger againe; that when it is contracted it should not strut or arise vp, especially when wee bend the second or third ioynt of the fingers. For were it not for this transuerse Ligament which streightneth or bindeth the tendons in the place before named, they would not in their contraction be curued backward but would arise vppe like right Chords, lift vp the skin and fill the ball of the hand, whereas the Ligaments although the tendons be contracted, do yet keepe them close vpon the bones into which they are not infixed, and so the way ouer the Ligament is smooth and euen.

The trans-
uerse Liga-
ment.

The

The vse of this Muscle is primarily to bend the second ioynt, secondarily also the first, because in the passage they are firmly fastened together by the interposition of membranes and fibres, and indeed the first ioynt hath no other Muscle allotted for his flexion saving this onely.

The 2. Bender

The second *Bender* which *Laurentius* calleth *Musculum profundum*, the Deepe Muscle, lyeth behind the former [tab. 23 fig. 2, 4, G] being in the whole course, body and Tendons subiected vnder it euen to his insertion. It ariseth a little lower then the former from the pro- cesse of the Ell on the fore side thereof, [tab. 23, Fig. 2, u] and is stronger then it, because his motion is greater and of more moment. It is exactly fleshy and broad, occupying the middle part of the cubit and groweth both to the Ell from which it taketh strength, and also to the Ligament which ioyne the Ell to the Wand, and separateth the interior muscle from the exterior; but when it is descended lower then the middle of the cubit, it is angustated or groweth narrow [tab. 23, Fig. 2, x, Fig. 4, 8] and diuided into foure fleshy parts which are co- uered with a nervous coate and by degrees bring forth nervous and round tendons which perforate or make way through the Tendons of the former muscle. All these Tendons pas- sing vnder the transu. rse and membranous Ligan. ent of the wrist, are euery one of the in the ball of the hand inuested with proper membranous which are ioynd to the Tendons by ner- uous ties. Afterward they creepe vnder the foure Ligaments of the fingers, and passe through the holes or diuisions of the Tendons of the first Muscle, [tab. 23, Fig. 2, y] that so they may be implanted into the third ioynt, yet a little before their insertion they become broader, & in old men there is found a little bone like the *Sesam. n. Seede*, or like that wherewith we feede Ca- nary Birds, which hath the same vse & forme that the Patel bone or whirle bone of the knee; for as these smal bones do grow to the tendons of the first muscle, so they also grow to the ten- dons of the second muscle before they are inserted into the third bones of the fingers.

The vse of this Muscle is to bend the third ioynt of the foure fingers, yea which is more as *Arantius* hath obserued, it seemeth to contract twelue ioynts, because in his passage his tendons are affixed to the first and second ioynts by their membranous Ligaments.

And indeed if we obserue the motions of our hands well, when wee would moue the third ioynt, the two former are curued whether wee will or no, whereas the third and the second may be bent when the first is immouable and extended: & thus much of the Muscles which bend the foure fingers.

The exten-
ding muscles
of the fingers.
called *Vermi-
culares*.

The extending Muscles are 8. beside the *Interossei* of which wee shall intreat afterward: of these the first, second, third and fourth [tab. 23, fig. 2, n] are called *Lumbricales* or *Vermi- culares*, that is, the wormy Muscles, and do cleaue to the ball or palme of the hand. They are fleshy, small, round and long, and do lie vnder the tendons of the second muscle which bend the third bone of the foure fingers. They arise at the inside from those membranes of the Fin- gers which we said did euen now inuest the foure tendons: neither let it seeme hard that I say they arise from membranes, because the muscles also of the eye take their beginning from membranes. Afterward they runne along the finger on the inside, and with a nervous and small tendon they doe adhere to the tendon of the Muscle next to be described, which ex- tendeth the foure fingers. Their insertion is made about the middle of the first ioynt into the second. Wherefore when these muscles are contracted to their originals, the second and third ioynts of the fingers, together with the helpe of the Muscles called *Interossei*, are primarily extended, although the Fingers also are extended by accident, that in great constraynts they might seme to assist oblique motions. For because the Tendons of these Muscles in their passage to the exterior part of the Fingers are tyed to the laterall or side ligament of the first ioynt, they are able also with a slender motion to leade the first knuckle vnto the thumbe: and because the tendons of the next muscle to bee described are seated on the outside and therefore obnoxious to outward iniuries, Nature placed these on the inside that if by mishap the outward Tendons were violated or wounded, yet the Fingers by the helpe of these might bee extended, and this is the manner of the position of the first foure extending Muscles.

[table 23, is the same with table 19, Folio 781.]

The 5. exten-
der.

The fift Extender [tab. 24, Fig. 1, and 2, at the lower p which in the second figure hangeth downe] ariseth with an originall mixed of a fleshy and nervous substance [6] from the outward protuberation of the arme. Afterward it becommeth more fleshy, and de- scending

scending in the hinder part betwixt the Ell and the Wand, is neere the wrist about [b] much narrower, and for the most part clouen into three, rarely into foure fleshy parts, which presently degenerate into nervous Tendons exquisitely round for their better security; which Tendons are tyed together by a membranous ligament arising from the appendix of the Wand, and so are together conueighed (through a cavity exsculped or wrought in the external part of the Wand) into the wrist. And least these Tendons should at any time fall out of that cavity or when the muscle is contracted, strut vp as we see a broken veine doth, they are inuolued with an annular or round ligament. [tab. 22. fig. 2, and 4. charact. 3.] Presently after vnder the wrist they recede or depart one from another, remaining no more round, but becoming broad because the bone on the outside is round of it selfe: and one runneth vnto the second and the third ioynts of the fore-finger, another of the middle finger, and the third of the Ring-finger. And hence it is that we feele so great paine if any thing get betwixt the nayles and the flesh. Sometimes it is diuided into two Tendons onely, which are inserted into the fore and middle fingers.

The vse of this muscle is to extend the second and third ioynts of those three fingers. And the Tendons of it are long, for the bellies do not reach vnto the wrist, that the hand might be lighter and more slender for agility in his motion.

The sixth extender [tab. 24. fig. 1, and 2, 2] is slender and long, hauing a sharpe and nervous originall, which is taken from the same protuberation of the arme with the former, afterward becoming fleshy it is mingled with the former vnto the middle of his belly, so that in their originall they seeme to be but one muscle. It passeth along the Cubit through a cavity common to the Ell and the Wand, and running vnder the transuerse ligament is sometimes diuided into two nervous and round Tendons, sometimes it remaineth single. If double, one is implanted into the posterior part of the three bones of the Ring-finger, the other becoming broader is fastned into the backpart of the 3 bones of the little finger.

His vse is to extend these fingers & to leade them a little outward, especially the little finger.

The seauenth extender [Tab. 24. fig. 2, and 3, R] lyeth vnder the two former, & ariseth exactly fleshy from the middle of the Ell where you shall meete with a long and rough line made of purpose for the rise of this muscle: thence it descendeth obliquely vnto the Wand and climbing ouer the appendix of the wrist is diuided into two tendons, [tab. 24. fig. 3, op] which are transported through a proper cavity in the appendix of the Wand, and vnder the transuerse ligament. [tab. 22. fig. 2, 3. char. 4.] The vpper of these Tendons is inserted at the roote of the forefinger for the most part, more rarely at the roote of the thumbe, the lower is inserted at the roote of the middle finger, sometimes onely saith *Fallopisus* of the fore-finger: both their insertions are oblique, and indeed the whole course of muscles is oblique. Their vse is to extend those fingers into which they are inserted: beside, that in extending the fore-finger, it also leadeh it from the thumbe.

The eight extender which is also the last, (not accounting the *Interossei* in this place) [tab. 22. fig. 1, 3, and tab. 24. fig. 1, 5] is seated within the hand. It ariseth short, strong, and fleshy from the fourth bone of the wrist, and passeth by the lower part of the *After-wrist*, so ascending vnto the roote of the little finger to the outward side of the first bone, in which it is inserted slender and nervous. His vse is to extend the little finger, & withall to leade it from the rest of the fingers when we desire to comprehend any round forme as a Ball or a Globe in our hands. This muscle resembleth the fashion of a Mouse, in because the beginning & the end it is slender, but in the middest round and thicke.

And these are all the eight extending muscles. There are also eight more extenders (for we reckoned sixteene in the end of the 27. chapter) called *interossei*, of which we will intreate in the next chapter saue one, because the method & order of dissection requires that we should first speake of those muscles that bend and extend the thumbe.

CHAP. XXXI.

Of the Muscles that bend and extend the thumbe.

As we said before that there were seauen muscles which did bend the thumb, and foure that did extend it.

The first bender of the thumbe [tab. 23. fig. 2, and 4, 1] is seated in the Cubit, and beareth vpon the second bending muscle of the foure fingers, [tab. 23. 6] to which it is a little continued at the ioynts betwixt the arme & the Cubit, but they beare one vpon another in their whole progresse.

Insertion.

The cause of paine vnder the nail.

The vse.

The sixth extender.

His originall.

Implantation.

Vse.

The seauenth extender.

His originall.

Implantation.

Vse.

The eight extender.

His originall.

Implantation.

Vse.

The *interossei*.

The 1 bender.

It

It ariseth with a round and fleshy originall out of that part of the Ell which is next the ioynt of the Cubit where it receiue the head of the *Radius* or wand, and so it runneth along the wand to which it groweth throughout as if the whole length of the wand did minister vnto it a continuatd originall.

Progresse,

Moreover it getteth an additament or increase by a portion it receiue from the Membranous Ligament [tab. 2.3. fig. 4.] and then running on to the wrist it determineth into a round and neruous tendon which together with the two benders of the foure Fingers creepe vnder the annular Ligament of the wrist to whose side also it is fastned. In that place it is covered with a proper mucous or slimy membrane and is hidden betweene the muscles which bend the first and second bone of the Thumbe in a cavity of a bone of the wrist which sustained the thumbe and is hollowed onely for this tendons sake. Afterward it is receiued vnder the transuerse ligament of the second bone of the thumbe and dilated into his third ioynt where it is very strongly inserted and serueth to bend it. This muscle is thicker then that which bendeth the second finger, because the thumbe is of greater strength and magnitude then the rest of the fingers. In Munkeyes (saith *Bauhine*) this muscle is not found, yet *Vesalius* describeth a Substitute for it.

Munchies,

The 2. Bender

The second Bender of the thumbe [tab. 23. fig. 1. and 2. K] ariseth fleshy from the vpper part of the annular or transuerse Ligament which is in the wrist, [tab. 23. fig. 1. V] and is fastned to all the inner region of the first bone of the thumbe, to which also it is fleshy inserted, yet obscurely; it toucheth also the second bone.

The 3. bender

The third Bender [tab. 23. fig. 24. LL] lyeth vnder the second and is farre lesse then it. It ariseth partly out of the same place with the former, partly from the bone of the wrist which lyeth vnder the thumbe and is inserted into the root of the first bone of the thumbe as farre as his middle. These two last described muscles doe bend the first ioynt of the thumbe and together with the third extender of the thumbe do make that mountaine or hillocke of flesh which is seated at the roote of the thumbe.

The vse. of 2 and 3.

The 4. bender

The fourth Bender [tab. 23. f. 4. char. 1, 2, 3. do note this muscle with those that follow next] arising with a slender and broad originall from that bone of the After-wrist which lyeth before the fore-finger, from thence it proceedeth fleshy yet somewhat narrower, and is inserted with a membranous tendon into that side of the second bone of the thumbe which is next the fore-finger.

The fift.

The fift Bender toucheth the former; is answerable to it in his originall, and being fleshy proceedeth out of the middle part of the bone of the After-wrist which lyeth vnder the middle finger. Some part of it also toucheth that bone which lyeth vnder the Ring-finger, and becomming fleshy is inserted with a small tendon into the middle of the second bone of the thumbe on the inside.

The sixth.

The sixt Bender ariseth somewhat broad from that bone of the After-wrist which sustaineth the ring-finger, and is inserted into the same place with the former: sometimes also it proceedeth with a neruous originall from the bone of the After-wrist which is vnder the little finger where it is ioynd with the wrist.

The position of the 4. 5. 6.

[Table 24. Is the same with Tab. 20. in fol. 783]
These three muscles seated vnder the line of life, haue a semicircular and distinct originall, but yet do all determine into one and the same tendon which is tyed to the inner Seede-bone which also is the greatest of all the seede-bones in the fingers, and is inserted into the side of the second bone of the same finger. And as those muscles which heereafter we shall call *inter-ossi*, seated in the after-wrist are carried directly or with a straight line, so those which bend the first bone of the thumbe run somewhat obliquely, and those that bend the second ioynt of the thumbe doe run almost transuerse or ouerthwart.

The vse.

These Muscles if they be contracted together do moue the second ioynt of the Thumbe toward the ball of the Hand. If the first of the three moue alone, the thumbe is led vpperward toward the fore-finger: if the second, it is led vnto the middle finger, if the third then is the thumbe bent downward and toward the little finger.

The seuenth.

The seauenth Bender of the Thumbe lyeth vnder these three last & is fleshy; arising from the bone of the After-wrist which sustaineth the fore-finger below the middle, euen at the iuncture thereof with the wrist. It is also ioynd (as the three last mentioned) to the second bone of the thumbe hauing a transuerse position, and occupieth the space which is betwixt the thumbe and the fore-finger. The vse of it is to draw the thumbe toward the fore-finger and to lay it thereupon. And so much of the Bending Muscles of the thumbe.

The

The *extenders* of the Thumbe are foure. The first [*tab. 24, fig. 1, the lower T*] ariseth fleshy from the outside of the cubit at his rough line neare the membranous ligament [*tab. 24, fig. 4, **] which ioyneth the cubit to the *Radius*, and passing obliquely toward the *Wand*, before it touch his appendix determineth into a round and neruous Tendon which attaineth vnto the hand through the cavity by which the by-horned muscle of the wrist doth descend vnto the ligament: and is inserted into the whole length of the Thumbe on that side which is next the fore-finger as farre as to the third ioynt. His vse is, to extend the thumbe toward the fore-finger, and to leade it from the wrist, and therefore moueth it side-long.

The second *extender* [*tab. 24, fi. 2, 3, v*] ariseth fleshy from the same line of the cubit after his length, and climbing obliquely ouer the *Wand*, is diuided into two vnequall parts, which cleaue one to another, and is seated in a proper cavity insculped or ingrauen into the appendix of the *Wand*, and is inuested with a peculiar ligament. [*tab. 22, Fig. 2, and 4, char. 6.*] The vpper part remaining a while fleshy, determineth into a Tendon almost round, and is implanted into the vtter side of that bone of the wrist which lieth vnder the thumbe. [*K*] The lower [*L*] is subdiuided into two fleshy portions, both which doe end into a Tendon: one of them groweth very strongly to the roote of the first ioynt of the Thumbe: [*m*] the other with the membranous tie cleaueth close to his second and third bones. [*n*] His vse is to extend the Thumbe inward.

The third *extender* [*tab. 22, Fig. 4, P. Tab. 23, Fig. 1, x.*] ariseth with a neruous originall, (which presently after becomes fleshy) from the inner part of the bone of the wrist which sustaineth the Thumbe. After being carried downeward, it is inserted with a membranous Tendon into the first ioynt of the Thumbe which it leadeth from the foure-fingers. This muscle with the second and third benders of the Thumbe make that fleshy portion of the palme which is at the roote of the Thumbe, we commonly call it the brawne of the hand.

The fourth *extender* [*tab. 24, Fig. 1, 2, 3, 4, z.*] occupieth the space which is betwixt the Thumbe and the fore-finger. It ariseth fleshy (partly also finewy) from the inner and backer part of the bone of the After-wrist which lies vnder the fore-finger, and is fleshy inserted on the whole outside into the first ioynt of the thumbe. Moreouer it trasmitteth a membranous Tendon to the second, which *Fallopins* in his *Institutions* acknowledgeth he hath found, but in his obseruations he saith he could neuer meete with it. This muscle serueth for the laterall motions of the Thumbe. It leadeth it also to, and layeth it vpon the fore-finger. And so much for the muscles of the Thumbe as well benders as extenders. Now we proceede to the muscles of the After-wrist and wrist.

CHAP. XXXII.

Of the Muscles of the After-wrist and the wrist.

THE After-wrist called *Metacarpus* or *Postbrachiale*, is a part of the hand seated betwene the wrist & the fingers. It hath eight Muscles, for in euery distance betwixt bone and bone, there are two Muscles which are fastened to the sides of the bones and therefore are called *Interossei*. Those that arise from the bones to which they grow, are throughout fleshy and run directly according to the length of the bones, creeping on the back-sides of their fingers, and their Tendons are mixed with the Tendons of the foure first extending muscles of the fingers which we called the Worme-muscles. Sometime this mixture is made before their Insertion, so that the wormy and bone-bound Muscles do seeme to make but one broad Tendon.

They are a little gathered or bound together by a Ligament of the first ioynt, and run by the sides to the outward Tendons of the fist muscle that distendeth the fingers, into which also they are inserted and with them are the authors of the extension of the second and third ioynts of all the Fingers; and because they cleaue to the sides of the fingers, it should seeme they were ordained to part the fingers asunder, and to leade them againe together.

Hence it is, that if a man be wounded on the outside of the After-wrist, he loseth the motion of the first ioynts of the fingers, because the muscle which extendeth the finger is cut asunder, yet the second and third ioynts are strongly and quickly extended because these small muscles do remaine sound. These muscles do make the inward cauitie in the After-wrist so plaine and equall (like as others do the same in the foote) that the particular Tendons

The extenders
of the thumbe
The first
His originall
Insertion.

and vse.

The second.
His originall.

Diuision.

Implantation.

Vse.

The third.
originall.

Insertion.
Vse.

The fourth.
originall.

Insertion.

His vse.

The After.
wrist.

The Muscles
called *Interossei*,
that is,
bone-bound.
Their originall.
Vnion
with the wormy
muscles.

Insertion.
Vse.

A note for
Surgeons.

of

Bbbb

of these muscles may run directly to the performance of their offices vpon a smooth and soft bed. They are also by this meanes secured from the offence which they could not otherwise but receiue by the hardnesse of the bones vnder them. Finally, they do not suffer those muscles together with the fat placed aboue them, to bee exiccated or dried but maintaine and cherish their moysture.

The muscles
of the wrist.

The next part of the Hand is the wrist called *Carpus* or *Brachiale*, and is in the midst betwixt the Cubit and the After-wrist. The motions of the wrist are to be bent, to be extended & to be inclined to either side, wherewith also the rest of the hand is mooued with one and the same motion, and all this is performed by the helpe of foure Muscles, whereof two seated within do bend, and two extend which are seated without.

The first bender.

The first bender which is also the lower, [tab. 22. f. 1, 3, 4. and tab. 23. f. 1, and tab. 24. f. 1, and 2, Δ] ariseth with an acute originall (mixed of a fleshy & neruous substance) from the inner or lower protuberation of the arme, and being fleshy strengthneth himselfe by adhering vnto the length of the Ell euen vnto the wrist, and for retribution serueth the bone for a pillow, which vse we especially make of it when we write, for then we leane vpon this muscle. Presently after, that is to say at the very wrist, it degenerateth into a fleshy and neruous Tendon which is implanted into the fourth bone of the wrist called by *Galen* *Os Cartilaginofum*, & to the Ligaments of that Ioynt it is connected & compassed about with a common Membrane, [is his beginning and his insertion.]

The second bender.

The second Bender or the vpper [tab. 22. f. 1, and 2. and tab. 23. f. and 6] ariseth from the same protuberation and descendeth obliquely after the length of the Wand, but before it come to the roote of the Wrist it endeth into a strong Tendon, which hauing ouer-past, the inside of the wrist becommeth broader, and is inserted into the roote of the bone of the After-wrist which sustaineth the fore-finger. It groweth also vnto the transuerse Ligament.

The vse of the
two Benders.

These two Muscles if they worke together do bend the Wrist forward, and secondarily the hand also: but when one of them onely worketh it mooueth obliquely now vppward now downward that part of the Wrist into which it is infixed, yet it giueth some ayde to the two Muscles which are seated without.

The first Extender.

The first Extender or the lower [tab. 22. f. 4. and 24. f. 1 and 2, Δ] seated betwixt the first muscle of the Wrist and the first extender of the Fingers, taketh his originall aswell from the roote of the externall or vpper protuberation of the arme, as also from the top of the cubite which it embraceth; it runneth through his length, and when it attaineth to the Wrist, it is infixed with a round, neruous and strong Tendon aboue the appendix of the Cubit into the bone of the After-wrist which lyeth vnder the little Finger, and not farre from the Wrist. Sometimes also before his Insertion, it hath a Seede-bone growing to it.

The second Extender.

The second Extender or the vpper which is also called *Bicornis* or the two-horned Muscle [tab. 22. f. 2, 4. c and tab. 21. f. 2, 3. E] ariseth fleshy with a broad beginning from the bony edge which is in the arme aboue the exterior protuberation [tab. 24. f. 3, X] It runneth vpon the Wand and aboue the middest of it determineth into a thicke, strong, and double horned Tendon, whence it hath his name saith *Columbus* and *Archangelus*, and when it hath directly ridden ouer the Wrist, the one of them is inserted into the first bone of the After-wrist, which sustaineth the fore-finger and into the extremity or end of the Wand: the other is infixed into the second bone of the After-wrist, vppon which the middle Finger leaneth. *Archangelus* saith that hee hath often found this two-horned muscle double, that is to say, two Muscles; one greater whose originall was neruous, and whose Tendon ended below the ioynt of the arme into foure Fingers. The other lesse, whose originall was neruous also, but his Tendon ended in the middest of the Wand. Hee addeth also that his Tendons are first broad, afterward round.

The vse of the
2. extenders.

These two extending Muscles if they worke together, doe bend the wrist outward and extend it primarily, secondarily also the hand; and are holpen by a portion of the thirde muscles which extendeth the Thumbe. Secondarily also they leade the Wrist about when one in his motion immediately followeth another. But when one of them onely worketh, then diuers motions are produced: for if cyther they worke asunder, or one of the benders worke together with an extender, it mooueth the Wrist obliquely and to the side. And thus much of the Muscles of the After-Wrist and the Wrist, now wee proceed vnto the Muscles of the Chest.

CHAP. XXXIII.

Of the Muscles of Respiration.

THe Chest contrayneth the Instruments or Organs of life : Life cannot be maintayned without Respiration, neither can Respiration be performed without motion ; it followeth therefore that the Chest must needs be moued for Respiration sake. If it be demanded why Respiration is so necessary, we answer, because of the high and great heate of the Heart, which by the ayre attracted in Respiration is refrigerated and cooled, euen as a mans face in Summer is cooled by a fan that wafteth fresh ayre vnto it.

Now the Chest is moued either by it selfe or by accident when it followeth the motion of the Spine or Rackbones of the backe, for when the backe is bent the Chest is also bent with it.

It is moued by it selfe and with a proper and peculiar motion for Respiration sake, which Respiration is accomplished by a double motion of the Chest, which is dilated when Inspiration is made, that is, when we draw the ayre into our Longues and so coole the heate of our Hearts; or contracted in Expiration, that is, when the ayre is driuen backe through the Rough artery for the generation of the voyce, and the footy excrements are blowne away least the Heart should be suffocated by them.

In these motions of the Chest wee must consider notwithstanding, that in Inspiration the lower parts of the Chest are dilated and the vpper angustated or straytned : on the contrary in Expiration the lower are constringed or straytned, the vpper dilated. And this was the reason why the Chest was not made of one bone as was the Scull, but of many, which also are ioyned together by gristles that their motion might be more pliant and easie.

But as the heart is moued with Naturall motion, so the Chest is moued partly with Naturally partly with Voluntary motion : with Naturall, because in our sleepe it is moued Naturally not according to our Will. With Voluntary, for wee haue read of some that by retaining their breath haue hastned death vpon themselves. As for the Longues they follow the motion of the Chest especially to auoyde vacuity, as well in those that sleepe as in those that are awake.

Philosophers doe differ much concerning these motions, but because wee haue already touched vpon their disputation in the tenth question of the sixt Booke, wee will not here Tautologize though haply we might say something new, because this Volume groweth far beyond that extent which was first limited for it.

The Chest therefore needed Muscles for Respiration, Respiration is absolued by his Diastole or dilatation when we breath in, and by his Systole or contraction when we breath out. These Muscles are in all 65. on each side 32. that is to say, 22. *Intercostall* Muscles, 11. internal and as many external, and one which is common to both sides called *septum transversum* or the Midriffe. Of these wee haue spoken before in the fourth and fift Chapters of the sixt Booke.

There remaine yet the proper Muscles of the Chest, fixe on either side, vnlesse it please you to adde three more according to *Fallopins* : Finally, the Muscles of the *Abdomen* (which helpe also our Respiration) are on each side foure beside the *Pyramidals* or Spirie Muscles, so that the whole summe will now amount to 71.

Of these some are Common, as the Muscles of the *Abdomen* which beside Respiration doe serue also for other purposes, others are Proper and serue for Respiration alone. But Respiration is double, one Free or naturall, the other constrained or violent.

That wee call Free which is done gently and easily, that is, when in Inspiration there is without constraint so much ayre drawne in as may suffice for the generation of vitall spirits, and in Expiration when a part of the attracted ayre is againe gently returned for the generation of the voyce, and both these are wrought by the motion of the Midriffe alone.

The first by the Contraction of the Midriffe wherein the end of the bastard ribs are gathered a little vpward, the lower and forward part of the Chest angustated or straitned and the backepart enlarged to the Racke bones, the seauen lower ribbes parted as it were asunder and so the Chest dilated. The second, when the Midriffe is relaxed or loosened, for then the Chest doeth easily fall with his owne waight.

We call that Respiration constrained, when the Dilatation or Contraction of the Chest is constrained,

Why the chest
mouethHis different
motions,Why not bone
ny.The kinds of
motion,How respira-
tion is made
The number
of the muscles
of respiration.2 kinds of re-
spiration,

Free.

Violent.

eident, that is, when in Inspiration the breath is drawne with violence or vehemencie, as it happeneth when the heart is too much heated: and in Expiration when the ayre is forcibly blowne out, as when we would speake or hallow aloud, when wee would cough or sneese, or else when vpon expulsion it is retained when we would make vse of the midriffe in euacuation of excrements or such like.

How the muscles moue.

This respiration is absolved by sixtie foure Muscles assisted by the midriffe, yet so that in Inspiration fewer Muscles do labour then in Expiration. In Inspiration, that which is called *Subclavius*, *Serratus maior*, *Serratus posticus superior & inferior*, and *Fallopian* his 3. Muscles. The Intercoftall muscles doe also conferre to this businesse, but that by accident onely. In Expiration more muscles are required, because we breathe out with greater strength then we breathe in; these are called *Sacro-lumbus*, *triangularis*, and all the Intercoftalls; for the exterior doe leade the lower ribs vpward, and the interior the vpward ribs downward. The eight Muscles of the *Abdomen*, and haply in great necessities the Muscles of the arme and the shoulder blades doe lend their helping hands. The Intercoftall muscles wee will here altogether passe over, as also the midriffe, because we haue spoken of them at large before. The muscles of the *Abdomen* we referre vnto the next chapter, here we will onely handle the proper muscles of the Chest, which grow thereto. These are accounted by *Galen* eight, and so many they are indeed in Apes, but in men there are but sixe in either side commonly receiued, to which *Falopius* addes three.

Their position of the muscles.

Two of these muscles are seated before, the one called *Subclavius*, the other *Triangularis*, one occupieth the sides called *Serratus Maior*, the rest lie vpon the back part, three in the backe, two called *Serrati postici*, and the third *Sacro-lumbus*; three in the necke, and these are

Tab. 25. Sheweth the Muscles especially of the chest, the head and of the shoulder-blade.

TABVLA XXV.



- A, The fourth muscle of the Chest, or the vpper and hinder Saw-muscle.
 B, the 5 muscle of the chest or the lower and hinder Saw-muscle.
 a, b, A membranous beginning of the muscle of the *Abdomen*, descending obliquely downe from the Spine of the backe.
 C, the 1 muscle extending the Cubit at c his originall is from the necke of the arme, and from the lower basis of the blade at d.
 E, the originall of the fourth muscle of the bone *hys* from the blade.
 G, G, the outward intercoftall muscles.
 I, the Clauicle or Collerbone bared.
 N, the vpper, the 2 muscle of the arme cald *Deltoid*, Char. 4, 5, the beginning of this muscle.
 N, the third muscle of the arme or the broad muscle separated.
 O, the fourth muscle of the arme or the lower *Super-Scapularis* or bladerider.
 I, 2, 3, Char. His originall at the basis of the shoulderblade at 1, 2, and his insertion into the ioynt of the arme at 3.
 Q, the sixt muscle of the arme or the vpper *Super-Scapularis*.
 X, The fourth muscle of the blade called *Leuator* or the heauer.
 Z, the second muscle of the Chest or the greater Saw-muscle.
 7, 7, Char. The ribs.
 T, the sixt muscle of the chest, or the muscle called *Sacro-lumbus*.
 A, The first muscle of the head or the splinter.
 EE, the second muscle of the head or the insertion of the muscles called *complexi*.
 s, The 2, muscle of the backe or the longest muscle.
 n, The fourth muscle of the backe called *Semispinatus*.

they

they which we said before were propounded by *Fallopianus*. But by *Vesalius* are esteemed to be parts of those muscles which occupy the necke and the backe, but wee come to the particulars.

The first proper muscle of the Chest is called *Subclavius*. [*tab. 17, r. tab. 22, fig. 3, r.*] the reason of the name is, because it is seated vnder the collar-bone which is called *Clavicula*, for it filleth that space which is betwixt the clauicle and the first rib.

1. subclavius.

This muscle ariseth fleshy from the inner and lower part of the clauicle which is next to the rib, runneth obliquely forward and is fleshy implanted into the vpper part of the first rib which is ioyned to the breast bone. His fibres are oblique, yea almost transverse. The vse of it is to draw the first rib vpperward and outward, and so the cavity of the chest is dilated.

The second muscle is called *Serratus Maior* or the greater Saw-muscle. [*tab. 10, 17, 25, 22*] It is a large muscle, situated in the side of the Chest, broad also and every way fleshy. His originall is large and fleshy from all the inner basis of the blade, and towards the ribs it is dilated, coucheth vpon them, is tyed to them by fibres, and is inserted as it were diuided into fingers into the eight vpper, sometimes also into the ninth rib, before they doe determine into their gristles. And these insertions of those muscles are acute or sharpe because of the tendons which descend obliquely with points like the teeth of a Saw, to meete with the teeth of the oblique descendent muscle of the *Abdomen*, with which they are finger-fanged as also is the lower and backward Saw.

2. Serratus maior.

The vse of this muscle is by the collection of his fibres in great and violent constraints or endeuours to draw the eight ribbes outward, and so to dilate the Chest. But in dogges and Apes it is not only inserted into the eight ribs, but implanted also into the transverse processes of the fourth, fifth, sixth and seauenth rackbones of the necke, or if you please it ariseth therefrom.

The third proper muscle of the Chest is called *Serratus posticus superior* [*table 25, 4*] the vpper backe-saw. It lyeth in the backe vnder the muscle called *Rhomboides* or the thirde muscle of the blade, betwixt both the blades and aboue the first muscle of the head. A little muscle it is, and ariseth broad and membranous from the spines of the three lower rack-bones of the necke and the first of the Chest. Afterward it passeth a little obliquely vnder the blade, becommeth fleshy, and being diuided into three parts is inserted into the three distances of the foure vpper ribs.

3. Serratus posticus sup.

The vse of it is to draw the ribs vpperward, to which it is implanted by contracting his fibres, and so the Chest is dilated and the hinder cavity thereof enlarged.

The fourth is called *Serratus posticus inferior*, the lower backe-saw [*tab. 25, B*] and seated almost in the middle of the backe vnder the broad muscle that is the third muscle of the arme. It ariseth membranous, nervous, broad and almost quadrangular like a combe as the other (but broader then it) from the Spines of the two lower rack-bones of the Chest, sometimes of the three, sometimes also from the vpper rackes of the loynes. Afterward it passeth ouerthwart and lyeth vpon the muscles of the backe, and being increased with fleshy fibres is inserted at the distances of the foure lower ribs before they determine into gristles. The insertion is made into the ribs themselves, and the muscle at the insertion is diuided as it were into fingers. It is much broader in men then in apes and dogs, and in dogs larger then in apes.

4. Serratus posticus infer.

The vse of this muscle is to draw the three or foure lower ribs outward, and so doth dilate the lower part of the Chest as we saide the second muscle did dilate the vpper part.

The fift muscle is called *Sacrolumbus* [*tab. 10, r.*] sayeth *Laurentius* and ariseth from the *Os sacrum* and the Spines of the *Lumbi* or loynes. This muscle may be thought to be common as well to the Chest as to the backe. It lyeth vnder the former, and ariseth fleshy from the backe part of the *holy-bone*, and the vpper and inner part of the haunch bone. Afterward it creepeth vpperward fastening it selfe to the transverse processes of the rackes of the loynes, and as farre as to the lower racke of the chest is mixed with the longe muscle of the backe, [*tab. 10, at 9*] so that a skilfull hand can very hardly separate them, and therefore it is esteemed but a portion thereof. [*tab. 10, 2, 3*] A little aboue the racke-bone of the Chest it departeth from the other muscles to which it doth grow, and becomming by degrees more slender, is inserted obliquely with round tendons not altogether fleshy produced from the outward side [*tab. 10, 37*] into fixe protuberations of the lower ribs which are their rootes. From thence (as *Fallopianus* rightly obserued) are produced fixe new fleshy muscles, nervous both in their originall and insertion, and are implanted into the fixe vpper ribs: so that from the twelfth rib

5. Sacrolumbus.

6. Fallopianus his 6. new muscles

where this muscle is inserted there ariseth a certaine Tendon, which becomming fleshy and climbing vpward looseth his flesh againe and is infixed into the sixth rib, carrying the resemblance of a slender muscle. In like manner from the eleventh rib proceedeth another Tendon which is inserted into the fifth rib, and one also from the tenth which is inserted into the fourth, one from the ninth into the third; finally, from the eighth and the seauenth which are implanted into the first ribs.

All these Tendons doe resemble distinct Muscles, yet they are so commixed together and with the *Sacrolumbus* in the surface that they seeme to bee partes thereof whereas indeed they are not, so sayth *Fallopins* in his obseruations. Wherefore when as the *Sacrolumbus* draweth the fixe inferior ribs backward and therewith downward, it moueth also together with them the fixe vpper foresayd additaments which are called *ansule* or the handles, and so constringeth the Chest.

The 6. proper muscle.

His originall

The sixth proper muscle of the Chest hath his name from the forme and is called *Triangularis* or the triangular muscle, because it consisteth of two long sides and one short. It is seated within the cavity of the Chest vnder the breast bone: little it is and slender, and in some men (especially if they be leane) there appeareth nothing fleshy in it. In some parts it is like a neruous Membrane stuffed with flesh. It ariseth from the lower part of the Breast-bone and passeth obliquely vpward and outward, growing to the gristles of the true ribs euen vnto the second: and this is the reason why the *Intercostall* Muscles and those which are called *Intercartilaginei*, that is, betwixt the gristles, doe appeare diuers, because of their diuers fibres. The vse of this muscle is to leade the gristles of the ribs together, and so to constringe the chest or to pressedowne the forepart thereof so much as is necessary for the Respiration, but in Dogs it is wholly fleshy and occupyeth the whole side of the Breast-bone.

Fallopins his 3. muscles.

Fallopins is of opinion that the first and the third Muscle are too weake to suffice for the eleuation of the Chest, for hee esteemeth the second rather to be a moouer of the blade; and therefore he saith that there are three other muscles which performe this office placed in the necke, which *Vesalius* in his Apology accounteth for partes of these Muscles which occupy the necke and the backe.

The first of these three ariseth with a neruous beginning from the inside of the transuerse processes of the 3. 4. 5. and sixe Racke-bones of the necke; then becomming more fleshy it is infixed into the first ribbe which it lifteth vp, and together with it the whole Chest.

The second is called *Scalenus*, because his figure is vnequally triangular, [Table 29. a. tab. 13. CC.] It ariseth fleshy from the transuerse processes of all the racke-bones of the necke, the first and second being sometimes excepted, and hath a fleshy insertion into the first rib, sometimes also into the second. This also serues to lift vp the Chest.

The third and last ariseth from the transuerse processes of the fourth and fifth rackes of the necke, and is implanted with a fleshy termination into the second ribbe sometimes into the third, and lifteth vp the rib into which it is implanted.

By these three muscles therefore and the *upper back saw*, *Fallopins* conceiueth that the chest is eleuated. And thus much shall suffice to haue sayde concerning the muscles of the Chest. Now follow the Muscles of the Abdomen.

CHAP. XXXIII.

Of the Muscles of the Abdomen or Paunch.

The order of the muscles of the Abdomen.

Here be tenne Muscles which couer the heather Belly, on either side siue called the Muscles of the Abdomen which are placed in this order. First doe appeare two obliquely or sidelong Descending & as many Ascending, which haply may more rightly be distinguished if they be called the oblique externall and oblique internall, for they all ascend equally as a mans eye please. Next two Pyramidall, after them two Right Muscles, and last of all two Transuerse or overthwart, so called according to the leading of the fibres which do mutually deuide themselves, as rightly so obliquely and sidelong.

The oblique or sidelong descending, or oblique externall Muscles [tab. 26. AB] so called of their oblique fibres [tab. 26. H] are placed in the sides: they are of a Triangle Figure, and amongst all the Muscles of the Abdomen the greatest and the broadest. These where they are more fleshy proceede from the top of the haunch-bone, [tab. 26. f] and from thence haue their

their strength and firmnesse; more neruous they proceede from the share-bone [tab. 26.g] where they are perforated, and membranous from the membrane springing out of the Ligaments of the spondels or racke-bones of the loynes: and so rise vpward and ending somewhat fleshy do cleaue to seauen, sometimes to eight of the lower ribs before they determine or end into their gristles.

Their situation.

That they doe arise from below it is manifest, because by all mens consent they serue to dilate the Breast and so helpe Inspiration; and therefore they must end in the Breast and not arise thence-from, because it is a ruled Axiom that euery Muscle draweth toward his owne originall not toward his insertion. They are therefore inserted into the great Saw-muscle [Tab. 26. ee tab. 27. p tab. 28. 000] at the 6. 7. 8. and 9. ribs as it were with [tab. 26. bb] a Finger-fould, as also into the lower backe Saw at the three lowest ribbs: sometimes they are ioyned to the Pectorall Muscle with a thinne neruous Tendon. Forward they [table 26. cc] are carried with a broad neruous and membranous Tendon, and in the middle of the Abdomen doe so mingle themselves at the white Line [tab. 26. ddd] that they make as it were a coare which spreadeth ouer all the Abdomen. These muscles are ioyned also to those vnder them by the interposition of a slimy substance like fast glew.

This white Line [tab. 26. ddd. tab. 27. ee. tab. 28. EE] is in the middle of the Abdomen, bred out of the concurrence or meeting of all the Tendons of these Muscles except the right. For the Tendons of the oblique muscles are so closely vnited, that it seemeth but one Tendon, and the Tendons of the inferior oblique do so grow to the Tendons of the transuerse where the right Muscles doe separate themselves, and so meete in one line, into which also the Pyramidall or spiry Muscles are implanted.

The white line.

This Line beginning at the Sword-like Cartilage or the Breast-blade neruous, passeth vnto the commissure or ioyning together of the share-bones: above the Nauell it spreadeth itselfe broader but below it is narrower: and is therefore white because there is no flesh or red soyle vnder it. It serueth to hold together all the Muscles as in a common end or termination, that so the right Muscles might remaine in the right side and the left in the left, and neither be halled ouer his limits. It hath also sometimes Fatte lying vpon it.

The vse.

The oblique ascendent [table 26. D table 27. i reflected from the abdomen] or oblique internal Muscles which doe intersect the former with their oblique ascendent fibres like S. Andrewes Crosse, or in the manner of the Greeke Letter χ [tab. 26. I H] doe occupy the middle part of the Abdomen, and are of a Triangular Figure. They arise fleshy from the appendize of the haunch-bone, and membranous from the membrane before named, and the Spines of the Holy-bone, and being increased with fleshy fibres and couering the haunches doe ascend vpward, and becomming fleshy are knit vnto the gristles of the foure lower ribs, and so are brought to the forepart of the Abdomen, and end in a broad neruous and membranous Tendon: which when it meeteth with the right [tab. 27. b] Muscles is diuided into two Tendons, one of which passeth above the right Muscle, the other creepeth vnder it (for which cause Galen writeth that the right Muscles are not couered with any externall Muscle, meaning there by Muscle Flesh, for that that couers them is indeede but a Tendon:) so that by this imbracement the length of the right muscles is fortified and kept safe from solution or breaking, and as it were hemmed in the midst of three muscles; where they doe not as before couer the muscle after the manner of a membrane, but doe so adhere to the intersections and partitions of the right muscles, that their tendons can bee very hardly seuered from them.

The oblique internal.

Their original

Their tendons.

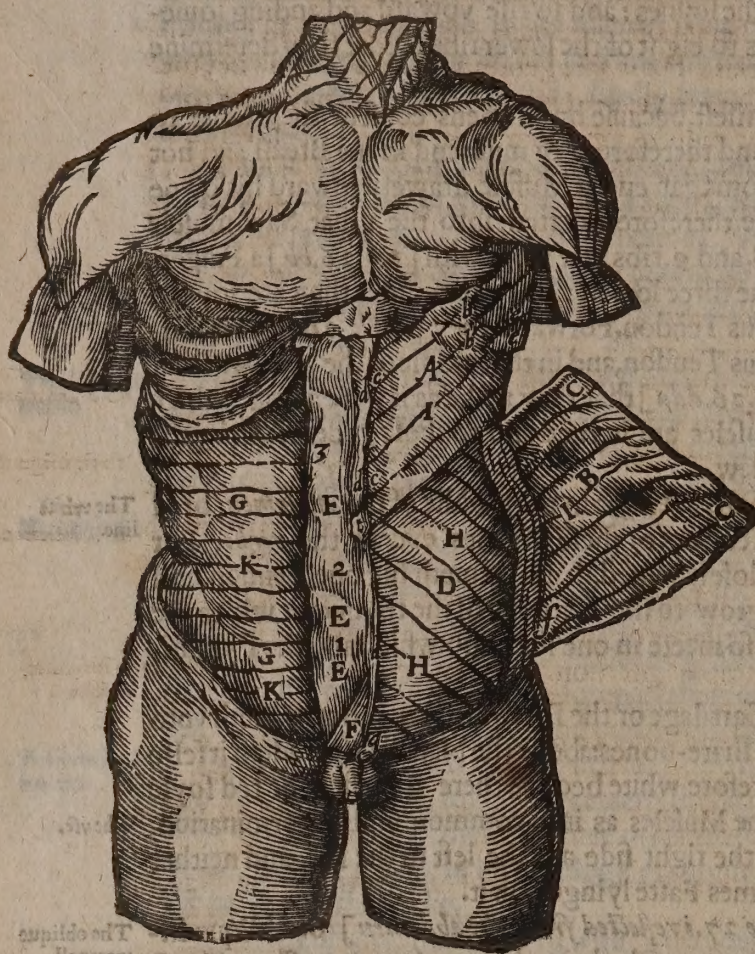
Being passed the right Muscles, they againe mingle themselves, are firmly and closely knit and vnited, and so goe hence away to the white Line [table 27. ee] framing as it were another membrane, and above doe meete with the Sword-like Cartilage or Gristle of the Chest. Below they meete a little vnder the Nauell, but the vpper Tendon is inserted into the share-bones.

These foure Muscles haue Veines and Arteries from the Muscle-veine and Artery, springing about the Loynes which are disseminated through all the region of the Abdomen and the Peritoneum or Rimme of the Belly: they receiue nerues also from the last spondels or racke bones of the Chest, which are inserted according as the leadings of the fibres are.

Their vessels.

The proper vse of the externall oblique Muscles, is when they worke together obliquely, to compress the vpper and side parts of the lower belly on either side, and of the oblique Internal in like manner to compress the lower and side parts: but wee must not conceiue

conceiue



Tab. 26. Sheweth all the Muscles of the lower belly, on the left side the oblique muscles, & on the right side the Pyramidall, the right and the transverse.

TABVLA. XXVI.

- A, The upper part of the oblique externall or descending muscle or separated, wherein his connexion at *b b*, with the Saw-muscle at *e e* is declared, and his implantation at *CC* into the white line at *dd*.
 B B, the lower part of the oblique descending muscle separated from the white line at *d*.
 C C, His Tendon.
 D, the oblique descending muscle.
 E E, the right muscle on the right side, from which both the oblique muscles are removed.
 1, 2, 3, The intersections of the right muscles.
 F, the Pyramidall muscle on the right hand, for both the left & the right pyramidal muscles are under the oblique.
 f, the fleshy originall of the oblique externall muscles from the haunch bone.
 g, Their beginning from the share-bone as also the Pyramidall muscles originall.
 GG, The transverse muscle.
 H H, The fibres of the oblique ascending muscle.
 i, The fibres of the oblique descending muscle that so the decussation may appeare.
 K K, The fibres of the transverse muscle.

ceive that all the lower belly is by these Muscles compressed, because their Tendons reach but a little below the Nauill. The compression is therefore made on either side but to the top of the groyne, for they are inserted into the gristly and moouable partes of the Ribbs.

The Pyramidal muscles.

They are often wanting.

The use of the spiry muscles.

The Pyramidall Muscles, so called from their forme like a Pyramis or Broch, arising from the outside of the sharebone [tab. 26. F, tab. 27. g] with a fleshy and nervous beginning (siding together like two parts of a spire, (for they are seldome so vnited that they make but one Muscle) doe clime with oblique fibres over the heads of the right Muscles from whom they are distinguished by a peculiar membrane and different fibres; and doe end in the white line (neuer in the right Muscles) with an acute Tendon of their owne, but one longer then another, neyther in length exceeding the breadth of foure fingers; but these though they be most commonly seene in dissections, yet in many bodies they are wanting, although Fallopius neuer dissected body but he found them.

The use of these spiry Muscles is to compress the bladder, for if one of them worke alone, it draweth the white line obliquely downward. If they worke together, they draw it directly downward, and so compress a part of the groine and the bladder there-vnder, when we make water at leisure. For if wee force our water with any violence, then the other Muscles of the Abdomen doe also helpe, pressing the whole paunch and with it the bladder. And if we marke our selues in such straining, we shall manifestly perceiue that the Abdomen is contracted downward; and hence it is that they are also called *Succenturiati* assistant Muscles because they helpe all the rest.

And if at any time (as it happeneth but seldome) these pyramidall Muscles bee wanting, then the oblique ascendents doe not take their first originall from the appendix of the

the haunch-bone
 pendix vnto the
 groyne as is the
 cles to which also
 ly) to be another
 the inspiration no
 of the right musc
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 Muscles.

The Right
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Tablo 27. Shew
 Pyramidall M

A. The right m
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 re the white line
 from another.
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 g, the Pyramidal
 h, the membran
 cleueth fast v
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 i, the oblique asc
 domen.

k, the product
 with the seede.
 m, the transverse
 no, the groynes.
 o, the circles wh
 p, the share-bone
 q, the greater S
 r, the lesser Saw
 s, His ampli

the haunch-bone, but lower from a strong ligament which runneth from the aforesaid appendix vnto the share-bone, & then they vrge obliquely downward whatsoeuer is vnder the groyne as is the bladder of the vrine. They also adde strength to the heads of the right muscles, to which also they serue as a defence. Whereupon some haue imagined the (though falsely) to be another originall of the right muscles. For if wee gently auoide our vrine neyther the inspiration nor expiration is interrupted, which yet certainly would be if they were parts of the right muscles, because when the right muscles are contracted, the Chest also is compressed, whence it would follow that when by the contraction of these muscles we would exclude our vrine, we cannot draw in breath till wee remit or loosen the intention of the Muscles.

The Right muscles [tab. 26, EE. tab. 27. AA, they are marked with d d] haue their name both from their right fibres, and because they are placed according to the straight length of the body: they are situated vnder the neruous thinnesse of the oblique, and in some places ioyned vnto them: they occupy the higher place, whereupon their tumors being longer then round, may easily be distinguished from the tumors of other parts by their position. Their originall is neruous from the fore & vpper [tab. 27, bb, tab. 28, charact. 1, 2.] part of the share-bone, (not from the brest because the bones of the share, hips and haunches are not moued) but presently they become more fleshy, and climbing ouer the belly about the nauill do seeme as it were to bee vnited [tab. 27, f] which yet is but the vicinity of their originall: but by how much they ascend higher by so much are they more seuered [tab. 27, ee] and grow broader, and doe at length grow to the Cartilages or gristles of the lowest true ribs at the sides of the brest-bone with a fleshy and ample insertion. [tab. 27, cc] They are fleshy and strong the better to compress the fore side of the Abdomen, and haue three, seldome foure intersections or partitions very neruous and transuerse or ouerthwart [tab. 26, charact. 1, 2, 3, tab. 27, ddd] as it were hanked together, so that they seeme to be not one, but many paire of right muscles, diuided and distinguished by the trending or oblique bending of their fibres to these surled intersections.

These intersections are firme and solid membranes, whereof one is vnder the Nauill, two and sometimes three aboue it; all which are ordained cyther to strengthen the muscle which is appointed for especiall hard imployment, particularly in deepe expirations; or

Table 27. Sheweth the Right, the Transuerse, and the Pyramidall Muscles.

TABVLA XXVII.

AA, The right muscles of the Abdomen.

bb, their neruous originall.

cc, their implantation.

ddddd, their intersections.

ee, the white line where the right muscles doe depart one from another.

f, the coniunction of the right muscles vnder the Nauill.

g, the Pyramidall muscles.

h, the membrane of the oblique ascending muscle which cleaueth fast vnto the tendon of the transuerse muscle and so attaineth vnto the right muscle.

i, the oblique ascending muscle here reflected from the Abdomen.

kk, the production of the Peritoneum or rim of the belly with the seede-vessels.

lll, the transuerse muscles.

m, the groynes.

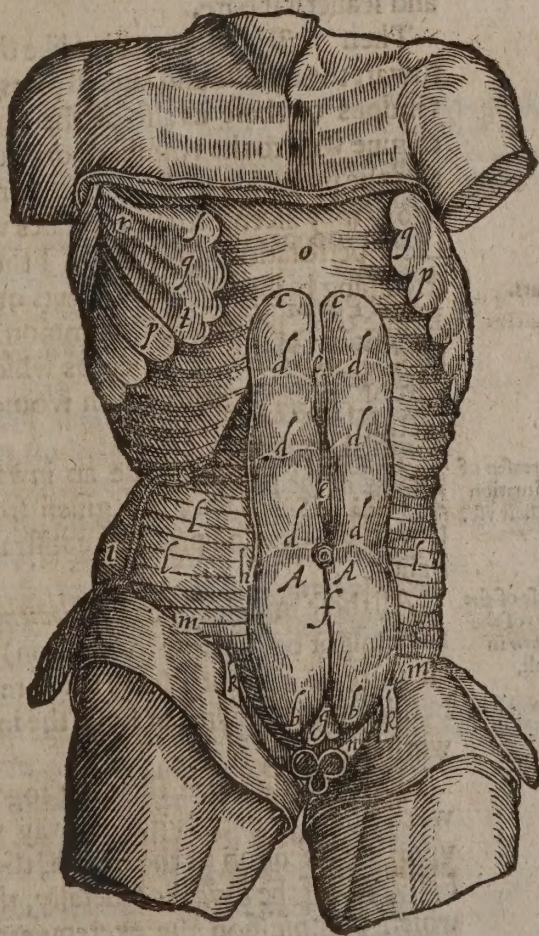
n, the circles which shew the bodies of the yarde cut away.

o, the share-bone without flesh.

pp, the greater Saw-muscle.

q, the lesser Saw-muscle.

r, s, t, His amplitude and fastening to the ribs.



else

else that being obliquated or *shelued* after the round figure of the *Abdomen* and fastened with the Tendons of the oblique ascendants they might more closely presse the *Peritoneum*. They haue veines which we call *Recurrents*, and arteries from the *Epigastricke* [tab. 28, 11. fig. 2, b] (from which also branches are sent to the necke of the womb) diuided into many furcles or tendrils for their nourishment and life. Which being led vpwrd vnder their bodyes are about the nauell, [tab. 28, fig. 2, c c] ioyned with the internall mammary or paps [tab. 28, fig. KK. fig. 4] veynes (which descend vnder the brest-bone) by *Anastomosis*, that is, inoculation of their extremities.

Anastomosis
what it is.

Which *Anastomosis* or kinde of vnion is the reason of the great consent betweene the wombe and the paps, the *Abdomen* and the nostrils. This consent of the wombe with the paps, is also increased by certaine internall veines, one called the *Axillarie* which goeth vnto the paps, and by the branches of the *Hypogastricall*, which are distributed vnto the wombe.

[Tab. 28. is the same with tab. 5. in the 2 Booke, fol. 78.]

They haue sometimes foure nerues most what proceeding out of the middle of the last spondels or rackbones of the Chest and so reaching to their hanked or surled interfections or distinctions. Their proper vse is to driue the highest and middle part of the lower belly not downward but directly to the Spine, to compresse it and to presse downe the lower parts of the Chest by drawing them directly downe ward. They helpe vs also in violent Expirations.

The vse of the
right muscle.

The transuerse
muscles.

The transuerse or ouerthwart Muscle, [Tab. 26, GG. tab. 27. III. and tab. 28. M. a part of it is reflected,] is placed ouerthwart the belly, and so named from the transuerse [tab. 26. KK] fibres which run through the breadth of their bodyes. These are vndermost and doe arise neruous from the inward endes of the bastard ribs, and the membrane twice before spoken of, and are inserted, being become more fleshy to the haunch-bones, [tab. 28. N. where the haunch-bones are bared, at which the transuerse and oblique Muscles doe meete and are implanted,] which after they haue inuested and attained to the vtmost sides of the neruous and membranous Tendon like that of the oblique Muscle, and tend vpwrd to the swordlike cartilage or brest blade, forward to the white line and downward to the groyne, and doe so closely adhere or cleaue to the *Peritoneum*, that in a man they can scarce bee cleanly separated from it, but in the groyne this *Aponeurosis* or broad Tendon forsaketh the *peritoneum* or rime, and leaueth it bare.

Ruptures.

Their vessels they receiue like the oblique Muscles. Their proper vse is to compres ouerthwart the middle and laterall parts of the lower belly, and especially the collicke gut. The tendons of these as also of the oblique Muscles are perforated at the exiture of the nauell to giue way to the vmbilicall or nauell vessels, and againe, on both sides neare the share bone, that the preparing vessels of seede may descend through them to the testicles, and the ciaculatory may ascend to the prostates which are annexed to the necke of the bladder. Through these perforations [tab. 28. *] the inward coate of the *peritoneum* being broken, or by stretching being dilated, the guts or the Kell slipping downe, cause the *Hernia* or Rupture. Beside those perforations common to both sexes, they are also bored in women for the passage of those sinewy processes which are called *Cremasteres*, which doe reach vnto the viter part of the lappe, whereupon women are troubled with the *Bubonocoele*, and of it are cured by section.

The reason of
their situation
from their vse.

That the transuerse haue an inward situation, the right a middle, and the oblique an external; a reason may bee giuen from Chirurgicall deligations or ligatures, because ouerthwart bandes doe presse or constrain more then right, and right more then oblique or side bands.

The vse of the
muscles of the
Abdomen in
generall.

All these muscles of the *Abdomen* (whose substance is partly membranous partly fleshy that they might be stronger for motion) haue this common vse with other Muscles, that whilest they are at rest they serue for a muniment or defence vnto the parts subiected vnder them, beside they contayne or hold the inward parts within their precinct, and keepe the body warme.

Particularly when they are together contracted toward their originals, and curued inward (the soft entrals giuing way vnto them) and are helped by the Midriffe depressed vpon the retention of the breath, then doe they equally and all ouer compresse the lower belly, (for if they worke seuerally, they presse sometimes one part, sometimes another) by which compression the excrements are thrust downe into the great guts and there re-
rayned

retayned at the fundament by the sphincter Muscle are thrust out by a reclusion or opening of the passage and a relaxation of that sphincter, and thereupon they bee called the instruments of the Excretion by *Galen* in the 15 chapter of his fifth booke *de usu partium*. But because the compression is equall from euery part, these excrements should as well be pressed vp to the stomack, as downe to the fundament, sauing that the midriffe by his oblique situation and the breath retayned, doth drine them downward and helpe Excretion. They assist the Mother also in the time of the birth, by constringing or binding the *Hypochondria* and by drawing downe the ribs. They helpe also the motions of the Chest, for saith *Galen* in the 14 chapter of the first booke *de usu partium*, they forme the voice, serue to inspiration and Expiration and in strong Effusions, as when a man windeth a Horne: yea sayeth *Galen* they helpe vs also to hold our breath.

Wherefore these Muscles doe night and day assist the breast in Respiration and the lower belly but at some times when we would vnburthen it, therefore they may be thought to bee principally ordayned for the motion of the Chest. Againe, because the Chest hath many other Muscles which doe distend and contract it, but the lower belly these alone, it may therefore be imagined that their primary vse is to bee referred to the lower belly, their secondary to the Chest.

Finally, if each Muscle worke by it selfe, then the oblique descendend drawes the haunch obliquely to his owne side, the right to the right side, the left to the left: the oblique ascendend leadeth the chest obliquely to the haunches; the transverse drawes the paunch, the right into the right side, the left into the left.

It is also worthy obseruation that the figure of these Muscles whether they labour or rest at quiet, is other and different from the figure of the other Muscles: for these of the *abdomen* before they worke are crooked, and in their contraction hauing soft bodies vnder them they are bended or crooked inward: all other Muscles whilest they are at rest are right, when they labour they are curued and bend outward, because of the bones against which otherwise they should offend. And thus much of the Muscles of the *Abdomen*: now we proccede vnto the backe.

The worke of each Muscle alone.

Their figure why differing from other muscles.

CHAP. XXXV.

Of the Muscles of the Backe.



He Muscles of the Backe as also of the whole Spine are so diuers, so mixed and knit together that some Anatomists haue diuided them into more, others into fewer Muscles, being led thereunto by reason of the infinite originals of the fibres and the multitude of their insertions. All this variety *Arantius* doth very wisely ascribe to the admirable wisdome of Nature, who hath therefore intertexted and wouen one within another these Muscles of the Backe, yea rather allowed them continuall and indiuisible particles, that they might the better sustaine and accomplish those strong and violent actions ouer which they haue the command. For if power vnited be the stronger, then certainly if many Muscles doe conspire together into one motion they will bee better able to absolue it. The Muscles therefore of the Backe together with the racke-bones were made to rayse vp and there to hold the whole bulke of the body, which is established on the holy-bone as vpon his foundation. We say therefore with *Galen* in the 14 chapter of his Booke *de dissect. muscul.* that because these muscles cannot by any meanes be truly separated, either there must bee so many payres as there be racke-bones, or else we must say that there is one onely payre offering tendinous distributions to all the *vertebrae*. And of this payre if one Muscle worke, the Spine is extended and inclined into his side; when they both worke equally, the Spine bending on neither hand by reason of their intention or remission is recurued backward.

Why the muscles of the backe are so wouen together.

But whereas almost all Muscles haue their Antagonists, that is, the authours of a contrary action to theirs (and therefore haue experience of their mutuall action and passion with an interposition of rest in the middle figure) yet notwithstanding these muscles of the Spine (if you except the bending Muscles of the necke) haue no Antagonists or contraries.

They haue no antagonists.

For because the inner Region of the Chest and the Loynes are destinated to those most noble entalles which serue for Respiration or Nourishment, it seemed not good to Nature to aduenture to prejudice or impeach their actions by any instruments of voluntary motion.

Whence

Four pairs
of the backe.

Whence it is that when these Muscles are relaxed (as they are in old men as well by reason of the waight and weaknesse of the body, as also because they abound with Phlegmatick humors) they are not able to containe or hold the body vpright. Norwithstanding Anatomists, because they haue obserued especially in Dancers and Tumblers, that the backe is moued forward, backward, to the sides, and almost semicircularly, they haue resolved that for the performance of these motions there are on either side foure muscles, *Laurentius* maketh ten, *Siluius* but fixe.

The first payre are called *Quadrati* the square muscles, [tab. 14, 22, tab. 11. and 29, 2] they arise broad, thicke and fleshy from the backward and vpper cavity of the haunch-bone, and from the inner and vpper of the holy-bone, and lye as it were square vpon the racks of the loynes, vpon which they climbe on the inside of the *Abdomen*. There they are a little streightened and cleauing to the transuerse processes of the racks of the loines are fleshy inserted into the lower part of the twelfth rib.

The fibres of this muscle doe ascend from without inward and obliquely vpperward, and those which proceede from the holy-bone are inserted into the lowest rack of the loines: the rest of the fibres which succede these toward the haunch-bone, doe by degrees determine into the vpper racks, so that in the whole course of this muscle the fibres are inserted to the transuerse processes of the racks of the loynes, and to their sides.

Their vse is to bend the racks of the loynes or the lower part of the backe with the right motion forward, but if one of them worke alone, then is the flexion oblique and the backe, downe to one side and together forward. The forme of this muscle in dogs and apes differeth much from his forme in men.

[Table 29. is the same with Table 12. of this booke.]

Position.

The second payre called *Longissimi*, [Tab. 12. 11, 12] are indeed the longest muscles in the whole body of man, for they reach from the lower end of the *holy-bone* vnto the first racke-bone of the chest, sometimes to the mamillary proceffe of the temple bones. They are like the fift paire of muscles of the chest called *Sacrolumbi*, [tab. 11, 1] to which in their originall and their proceffe thorow the loynes, they do grow as if they were a part of that paire. They are also the largest of all the muscles of the backe.

They arise with a very neruous, strong, & acute originall [Tab. 12.] from the top of the spine of the *holy-bone* [tab. 11. L.] passing through his length and from the spines of the five rack-bones of the loynes.

In the inside of the haunch-bone [table 29. 6] where they are ioyned to the *holy-bone* they produce a neruous original, saith *Fallopins*: a fleshy, saith *Vesalius*, vnder which neruous original as vnder a certaine ligament or couering lurketh another originall very fleshy.

Termination.

From hence ascending at the outer-side they become fleshy and are inserted into the transuerse processes of the racke-bones of the loynes: as also into all the transuerse processes of the racke-bones of the chest, growing by degrees narrower from the eleuenth vnto the first, where they offer one neruous tendon on the inside like a neruous handle, [tab. 11. MM] which is spread vpperward obliquely toward the outside, like as the muscles called *Sacrolumbi* did from the out-side offer a tendon along all the ribs. Sometime also they determine into the first *vertebra* of the chest: sometime departing from the processes they ascend vnto the mamillary proceffe of the temple-bone and there end.

A sinus in
them.

On their inside because of the thicknesse of the fleshy part and the tenuity or slendernesse of the neruous, there is grauen through their length a certaine *Sinus* or bosome, [tab. 26, be-
twixt *a* and *a*] to giue way to the third muscle of the backe which is called *Sacer*.

Their vse is directly to extend the backe and the loynes if they bee contracted together. *Columbus* and *Archangelus* thinke that they bend the whole backe and head also backward, so that our body thereby may be compassed into a halfe circle, which kind of Posture wee may see in Tumblers when they play their feates. But if one of them onely bee contracted, the spine is extended on one side, for their fibres are oblique.

The third paire are called *Sacri*, or the holy muscles, [tab. 29, 2] They lye vnder the former. They arise both touching one another, [tab. 29. X] with an acute originall from the vpper part of the holy-bone where the spine is fastened with the haunch-bones; as also from the transuerse processes & the roots of the spines of the racke-bones of the loines, [tab. 19, 8] or if you please, say with *Fallop.* that they ascend from these processes and are increast with diuers

diuers originalls; as also from the racks of the Chest, and that with a threefold originall, one higher from the end of each transuerse proceffe; another lower, as it were from the roote of the same proceffe, the third from the Spines of each racke bone: so that they seeme to bee three kinds of Muscles mixed together; one outward hauing long fibres, another inward hauing short, a third hauing yet shorter which ariseth from the Spines. After their originall they grow brode by degrees, but before their termination which is acute and made into the Spine of the twelfth, sometimes of the eleuenth spondell of the Chest, they become slender. Their fibres run obliquely vpward and inward. Their vse is, if they worke together and contract their fibres to extend that part of the Spine to which they are fastened. But if one of them alone worke, it extendeth a part of the backe obliquely, and putteth the body on the one side into a semicircular forme.

Termination
and vse.

The fourth paire are called *Semispinati*, [tab. 10. 11. 20. 25. A] they arise with an acute originall from the Spine of the twelfth racke bone, sometimes of the eleuenth of the Chest; and arising vpward by degrees they grow thicke and fleshy, especially at the Spine of the fifth racke of the Chest being intertexted or wouen with neruous fibres: they imbrace all the spines of the racks of the same. Presently after they become attenuated and doe determine with an acute end into the Spine of the first racke bone of the Chest. Their fibres are most what right. These Muscles as also the former paire doe fill vp the distances betwixt the Spines, where they are contiguous, that is, touch one another. And nothing beside a membranous ligament issuing from the vpper Spine into the lower commeth betweene them.

Originall.

Termination
Fibres.

Their vse is to gather together the Spines whereinto they are inserted, and to extend or lift vp that part of the backe to which they grow; or the backe properly called *Dorsum*, together with other Muscles, the loynes being vnmooued. When one of them onely worketh it mooueth the backe to the side; but when all eight Muscles conspire together, the whole backe is bowed directly downward. If foure worke together so as one follow another, they mooue it into a semicircle: but if the Muscles that be on the one side do worke alone, the body is inclined to that side. And thus much of the Muscles of the backe.

Their vse.

CHAP. XXXVI.

Of the Muscles of the Fundament, the Bladder, the Testicles and the Yard.

BEcause Man was a politique creature, made for Action and contemplation, it was fit that he should either receiue his nourishment, or auoyde his excrements perpetually as plants doe, but at his owne choyce. As therefore in the Chops there are Muscles seruing for digestion or swallowing, so in the end of the guts and the outlet of the vrine, there are Muscles set as porters to interclude the passage vnlesse we list to open it.

The spincters.

The Muscles therefore of the Fundament are foure, two *Sphincters*, and two *Leuators*, one of the spincters is fleshy [tab. 30. fig. 1. E] arising from the lower racks of the holy bone, and like a ring is so implicated with transuerse fibres to the extremity of the right gut, that it altogether shuttereth the Fundament. The other spincter is fleshy, and in my iudgement, saith *Laurentius*, seemes to be nothing else but hardened skinn wouen with fleshy fibres, therein following *Galen* in the thirtieth chaptet of his Booke de dissectione musculorum: *Falkopius* also is of the same mind, yet *Banbini* maketh but one Muscle of these two, which saith he, is tyed on the backe side to the rumpe bone, on the fore side with fibrous ryes to the outlet of the Bladder and to the Yord, to whose Muscles it affordeth an originall as also to the necke of the wombe. At the sides it is tyed with round ligaments produced out of the holy-bone vnto the haunch-bone, and is strangely commixed with the insertion of the *Leuators*.

Two leuators

The two *Leuators* [tab. 30. fig. 1. B C] doe lie vnder the Bladder, they are small Muscles, but neruous and broad arising from the ligaments of the share, haunch and holy bones, thence descending they reach vnto each side of the seate where they compass the gut, and

[Table 30. is the same with Tab. 12. in the 3. Booke.] are inserted into the vtter coate thereof, and the vpper part of the spincter, [tab. 30. fig. 1. E] a portion of them also groweth to the roote [tab. 30. fig. 1. D] of the Yord, and the necke of the Wombe. Whence it is that some haue made them three Muscles.

Their vse.

Their vse is after excretion to retract the Fundament, and if these Muscles bee weake or

Cccc

resolued,

resolved, then followeth that disease which they call *Ani-procidens*, or the falling of the Fundament.

Of the bladder.

The Bladder also hath a spincter Muscle seated in the beginning of his necke, from which it cannot be distinguished, and indeede it is nothing else but a more fleshy substance of the sayd necke woven with many transverse fibres, by which it is constringed. If this Muscle be either relaxed or refrigerated or wounded, the Urine followes against our willes. In women it is thicker then in men, because there be no prostate Glandules.

Of the Muscles of the Yarde we haue spoken before in the 8 chapter of the 4 Booke, which it shall not neede to repeate. Onely we remember that they are foure, two collaterall, and two called *Inferiores* or the lower muscles.

Of the Muscles also of the Testicles we haue spoken before in the 4 chapter of the 4 Booke. Remember onely that they are two and called *Cremasteres* or the suspending Muscles. Now we descend vnto the Muscles of the Legge.

CHAP. XXXVII.

Of the Muscles of the Legge.



Ecause the Muscles of the Thigh cannot bee demonstrated before the Muscles of the Legge are viewed, wee will first speake of the Muscles of the Legge, following therein the order of Dissection. The Legge therefore is that part of the Foote in the large acception, which is betwixt the knee and the Foote properly so called.

What the leg is.

It consisteth like the cubit of the bones: the one beareth the name of the whole and is called *Tibia* the Legge; the other is called *Fibula*, we may call it the *Brace-bone*. Now the Legge is mooued either by it selfe or by accident with three motions, for it is bent or extended directly, and it seemeth also to be mooued obliquely outward. It is bent by five Muscles, extended by foure, one onely mooueth obliquely. By accident the Legge is mooued after the Thigh, and that is either to one side or about. First we will entreate of the Benders.

His motions And number of his muscles.

The first.

The first Bender or the longest [*table 31, and those that follow, figure 1, 2, 4, 7, 8, a*] with which we meete on the foreside presently vnder the skiane; ariseth with an acute [*Fig. 1, 3, 7, 4*] neruous and fleshy originall from the inner appendix of the haunch-bone, presently becomming fleshy it runneth with a decussation like a slope swathe thorough the inside of the Thigh, being very slender and lying vpon the other Muscles. Neare the bone it is yet narrower [*fig. 1, 2, 7, 8, b*] and endeth in a neruous Tendon, which is inserted in the fore and inside of a sharpe line which is in the bone of the Legge [*Table 7, c, is the insertion of the first second and third Muscles of the Legge.*] His vse is the same with the two following, that is, to bend the Legge inward, and withall to lift it vpward.

The 2 muscle.

The second Muscle of the Legge which is also called *gracilis* or the slender Muscle, [*table 31, and those that follow, Fig. 1, 2, 4, 5, 7, 9, b*] is situated, (especially the belly of it) in respect of the former inward and so lyeth close vnto it. It ariseth with a neruous and large originall [*fig. 2, d, e*] at the meeting of the share bones to which also it groweth, and is as big and large as that commissure or meeting is: Afterward it becommeth narrower but more fleshy, attayning through the inside of the thigh vnto the knee it determineth into a Tendon exactly round at the inner head of the Thigh, not farre from the knee; where also the Muscle becommeth round before the Tendon grow from it. When the Tendon is a little dilated it is inserted into the Legge neare the first Muscle but a little more inward, and it is of the same vse with the former.

The third

The third bending Muscle which is called *Semi-neruosus* halfe sinewy, [*tab. 31, and those that follow, fig. 2, 3, 4, 5, 6, c*] is seated on the backside, and ariseth from the vpper part of the protuberation of the haunch-bone [*fig. 5, 6, f*] where it is neruous and slender, but about the middle of the Thigh it becommeth fleshy and maketh a rounde muscle, which descendeth a little obliquely by the backside and inside of the Thigh, at whose inner head it is reflected and attenuated [*fig. 5, g*] and inserted with a round tendon in a man (in Apes sometimes it is broad) into the forepart of the Legge, where also the two former were inserted, but the Tendon of this third descendeth vnto the middle of the Legge.

The fourth.

The fourth bender is called *Biceps* or the double headed muscle. [*tab. 31, and those that follow, fig. 1, 3, 4, 5, 6, 10, 13, d*] It ariseth with a neruous acute and slender originall, [*fig. 6, h*]

out

out of the lower part of the haunch-bone or out of his protuberation. Presently after it becommeth fleshy, and descending through the vter and backside of the thigh in the inside thereof about the middle where it appeareth nervous) it receiveth a fleshy portion [fig. 6, k] as it were a new Muscle arising out of the middle of the thigh whereby this Muscle is strengthened; for the outward part there is onely this one muscle, but on the inside there are foure. This portion is so mixed with the muscles when it produceth his Tendon, as if another muscle did therefrom arise. [fig. 6, k, s] Wherefore it may be numbred for one or for two muscles. A portion increasing it.

Both these descending and on the outside nervous, do end in a notable Tendon which is implanted into the acute proceffe of the *fibula* or the *Brace*. [fig. 10, d] For the behoefe also of this Tendon, the head of the Thigh hath a long externall *sinus* or cavity cruised ouer with a smooth and slippery Ligament wherein it is securely conueyed, and beside, least bending obliquely that way it should go out of his tract.

The first bender is called *semi-membraneus*, that is, the halfe membranous Muscle. [tab. The fifth, 31, and those that follow, fig. 2, 3, 4, 5, 6, 13, 14] It runneth through the backside of the thigh, and ariseth with a nervous and acute originall from the appendix or protuberation [fig. 6, m] of the haunch-bone neare the head of the third Muscle. [fig. 6, f] It continueth nervous longer then any Muscle of the body, but at the middle of the Thigh it beginneth to bee fleshy, and in his lower part thicke, and neare the knee endeth into a round Tendon, [Figure 6] wherewith (a little dilated) it is inserted into the inner side of the Leg, with the first second and third Muscles. This Muscle also being very liuid in the backpart beyond the middest hath a bosome or cavity in it, [fig. 6, n] whereupon the forepart of the third muscle leaneth, & in his whole course applyeth it selfe thereto, so that they appeare to be but one Muscle.

The sixt muscle of the Legge or the first extender which is called the *membranous Muscle*, [tab. 31, and those that follow fig. 1, 2, 4, 7, 8, 1] occupyeth the outward and middle part of the Thigh, and ariseth [Fig. 1, 4, 7, p] fleshy and sharpe from the Spine of the haunch-bone: and being conueyed to the ioynt of the hip (at which place onely it is fleshy) and becomming narrower it departeth neare the outside of the greater proceffe of the thigh, into a very long and broad [Fig. 7, *] membrane of the nature of a tendon, then which there is no greater in the whole body, for like a skinne or a transuerse Ligament it compasseth almost all the muscles of the thigh (but it is not in all places alike thicke) and holdeth them in their proper seates (as we saide before the muscles in the cubit were inuested) and incloseth also the ioynt of the knee. This Tendon at his insertion is mixed with the Tendons of the following muscles, and is infixed into the forepart and vter side of the Legge. His vse is to extend it directly and to mooue straight forward. The sixt or the first extender.

The seauenth or the second Extender, which is also because of his greatnesse called *Vastus externus*, *The Vast Externall Muscle*, is wholly liuid [tab. 31, and those that follow fig. 1, 3, 4, 5, 6, 8, 9, 10, 13, H] and occupyeth the outside of the thigh, as also a great part of the fore side and the backside. It ariseth [Fig. 9, r] with a broad large and nervous originall from the outside of the Thigh, and compasseth round about the roote of his great proceffe growing thereto. Presently after the originall it becommeth thicke and fleshy, and lying vppon a part of the eight, it is wholly fleshy, and a little about the whirle bone of the knee [Fig. 9, x] it endeth into a large and membranous Tendon, which being mixed with the Tendons of the two following muscles, descendeth at the outward side of the same whirlebone which it doth encompassse; and is inserted [Fig. 9, u] into the fore side of the Leg immediately vnder the ioynt. The seauenth.

The eight or the third Extender which is called *Vastus internus*, *The Internall Vast-Muscle*, [tab. 31, and those that follow, Fig. 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 0] compasseth (on the inside) almost all the circumference of the Thigh-bone. It ariseth fleshy from the necke [fig. 10, y] of the Thigh, and presently becomming fleshy, a portion of it groweth out of the roote of his greates proces as if it had a double originall. This latter originall (if you list so to call it) descendeth large and oblique, and becomming by degrees more fleshy it buncheth or beareth out at the inside of the thigh neare the whirle-bone into a thicke and fleshy semicircle, out of which groweth a strong tendon which occupyeth the whirle-bone also. [Fig. 9, u] This portion some do make a distinct muscle and call it *Crurium*. [Fig. 2, 7, 8, 9, Z] This muscle with the former maketh a *sinus* or bosome very liuid, [Fig. 9, char. 1] that the subsequent muscle might lye vppon it throughout his length. The eight.

The ninth or the fourth extender called also the *right Muscle*, [Tab. 31, and those that follow fig. 1, 2, 3, 4, 7, 8, 9, x] lyeth on the outside vppon the first bender, and is seated on the mid-

middest of the forepart. It ariseth with a nervous and acute originall [Figure 8. character 1.] from the internall protuberation of the haunch bone on the fore-side about the Cuppe of the Coxendix. From thence it is deriued directly through the length and forepart of the

Table 31. With those that follow, shew the sixe Muscles of the Legge, the Thigh, and of the foote. Fig. 1. sheweth the foote and musculous part of the left Thigh. Fig. 2. sheweth the internall and laterall part of it. And Fig. 3. sheweth the externall laterall part of it.

TABVLA XXXI.



the legge, called *Biceps* or the double headed muscle. *a* 1, 2, 3, the first muscle bending the legge called *membranosus*. *z* 1, 2, the first muscle extending the legge called *Vastus externus*. *9* 1, 2, the third muscle extending the Legge called *Vastus internus*. *u* 1, 2, 3, the fourth extender of the Leg, or the *Right* muscle. *u* 3, the first extender of the thigh, called *Gluteus maior*. *o* 2, the inner ankle. *o* 1, 3, the vtter ankle. *q* 1, A fleshy part of the first extender of the Leg. *q* 2, the first extender of the thigh called *Triceps* or the three headed muscle. *o* 2, the first bender of the thigh called *Lumbalis*. *r* 2, the second bender of the thigh called *Iliacus*. *v* 1, the third bender of the thigh. *z* 1, 2, the first extender of the foote, or the internall *Gastrocnimius*. *p* 1, A portion of the second extender of the toes, which *Vesalius* maketh the ninth muscle of the Foote. *q* 3, the greater proesse of the thigh called *Rotator*. *r* 3, the transuersel ligament reaching from the brace to the heele. *r* 2, A portion of the 5 muscle of the thigh, *x* 2, the bone of the Legge bare. *7* 1, 3, the tendon of the first extender of the toes. *z* 1, 3, A transuersel ligament above the foote.

A A, The holy-bone.
B 2, A ligament drawne from the holy-bone vnto the hip.
G 1, 2, the state of the holy-bone.
H 2, the third Muscle extending the soale called *Plantaris*.
I 1, the fourth muscle extending the foote or the soale muscle.
K 2, the fift muscle extending the foote, called *Tibialis Posticus*.
L 1, the first muscle bending the foote called *Tibialis Anticus*.
M 1, 2, the second bender of the foote called *Peronaeus primus*.
N 3, the third bender of the foote called *Peronaeus secundus*.
P 1, 3, the second extender of the toes, or the stretchers.
R, the second bender of the toes, or the great bender.
T 1, 2, the lower abductor of the great toe.
V 3, the abductor of the little toe.
** 2*, Tendons carried vnto the toes of the foote.
X 2, the internall part of the fourth muscle of the thigh as it were three-fold, at *a, c, f*.
Y 1, the vpper abductor of the toes.
a c f, A part of the tenth muscle of the thigh as it were three-fold at *a c f*, and carried vnto the great proesse of the thigh.
z 2, A greates nerue lying vppon the tenth muscle between *x* and *a*.
a 1, 2, the muscle of the Legge, or the first bender which is the longest muscle.
a 1, 3, His originall.
b, 1, 2, His tendon.
9 2, 2, the muscle of the Legge or the second bender which is the slender muscle.
d 2, His originall. *d* His tendon.
7 2, 3, the third muscle bending the tibia called *Seminernus*.
9 2, 3, the fourth muscle bending

thigh

thigh betwene the seauenth and the eight Muscles, and being by degrees increased with a fleshy substance it becommeth againe by degrees more slender about the middle of the thigh. [figure 8, character 2.] and determineth into a very long and exceeding strong tendon about the whirle, where it is a little narrower and more slender. But in the forepart of the whirle it is againe dilated, and being mixed with the tendons of the two forenamed muscles is very strongly inserted into the Legge on the foreside immediatly vnder the ioynt. But in Munkies, it is most what membranous and inserted into the Legge much lower. Neither this onely, but also the tendons of the other muscles are more membranous and broder in men then in Apes. And with this tendon of the three muscles is the whirle bone couered, yea it groweth to his forepart, and seruerth the knee for a ligament. This is the Muscle which is like a Snake or the fish (because of his broad taylor) which is called *Mus* or the *Mouise*, which vibereth the Whale that he offend not against the rockes, from which fish the Muscles of the whole body haue their denomination.

The tenth and last muscle of the Legge is called the *oblique moouer*, and from his situation *popliteus* the muscle of the Ham, [tab. 34, 38, figure 14, 16, 28, 29.] for it lurkes in the ham vnder that Muscle of the foote which is called *Gastrocnemius*, and *Plantaris* next of all to the bones, and therefore we cannot meete with it before these bee remooued. It is a short and slender Muscle and issueth with a neruous [fig. 16, character 4] and round originall from the externall head of the thigh, after it is increased with fleshy fibres and running vnder the ligament, climbing obliquely ouer the bone *Tibia* or the Legge, determineth broad and fleshy and is inserted into the backe and inner part of the Legge at his appendix. [tab. 31, character 5.] His vse is to mooue the Legge obliquely outward, and therewith also to turne the foote somewhat inward toward the other, for the foote is specially articulated with the Legge bone, and therefore *Galen* sayd that it was the principall author of the bending of the Legge.

CHAP. XXXVIII.

Of the Muscles of the Thigh.



HE Thigh is that part which is betwixt the ioynt of the huckle bone and the knee, and consisteth of one bone as doth the arme. This part because it is mooued according to our good pleasure by reason of his round head, and that with all kind of motion, it stood in neede to haue Muscles and those very many.

These Muscles doe mooue the thigh either directly or in compasse. Directly, either lengthwise or ouertwart, and that eyther by extention or by flexion. It is extended either when we stand vpriight and make (as we say) a curtesie, bending the thigh moderately inward and downeward toward the earth: Or backward into the posterior part when we lift our thighs vpward, especially toward the outside, which kinde of position may be seene in that they call a *Backe-caper*. This extention is made by the helpe of five Muscles, which most what doe occupie the posterior part. And the first foure of these doe lie vpon the huckle bone, and the fifth vpon the thigh.

The thigh is bent when we lift it vpward and forward, and especially toward the inside; (in extension it is toward the outside) as it is in Anticke dances, and this motion is performed by three Muscles situated before; two of them are seated in the cavity of the belly, and the third in the thigh.

The circumaction or compassing of the thigh is either inward or outward, and performed by three Muscles placed in the coxendix. Wee conclude therefore that there are eleuen muscles of the thigh, although I know many more may bee named if wee diuide the fifth muscle into foure; make two of the fleshy pouch which compasseth the tendon of the tenth Muscle, and adde the twelfth Muscle described by *Arantius*: for then each thigh shall haue seuenteen Muscles which shall extend it, bend it, leade it in compasse, draw one thigh to another, diuide them asunder, or lift one thigh ouer another, as Taylers vse to sit at their worke. Of all which motions we will speake in order.

The first extender is called *Gluteus maior* the greater buttocke muscle, because it maketh almost all the buttocke on one side; [tab. 31, and those that follow 3, 4, 8, 9.] for it is thicke and

Cccc 3

fleshy

fleshy and lyeth iust vnder the skin, being appoynted with the two following to make the quillion of the seare.

It ariseth with a fleshy broade and semi-circular originall, from the whole circumference of the haunch bones, from the lower part of the holy bone where it is contiguous with his opposite, and from the beginning of the rumpe-bone. [tab. 32, figure 4, a b c] Afterward descending a little obliquely and riding over the ioynt of the huckle-bone (which it strengthneth, as it were, with a couering) it becommeth narrow and more slender, and so

Table 32. Skeweth especially the Muscles of the Thigh and the Legge.

TABVLA. XXXII.

FIG. IV.

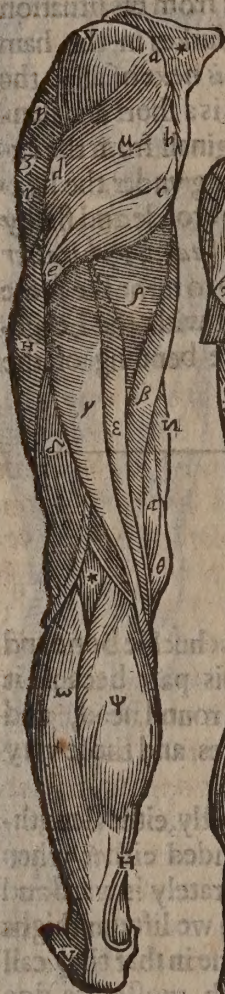


FIG. V.



FIG. VI.



a b c 4, the originall of the first extender of the thigh. d e, His insertion. f g, 5, 6, the originall of the third bender of the Legge called *Seminervosus* at f, the beginning of his tendon at g. i k, 5, the semicircular originall of the second extender of the thigh at b: His insertion into a proceffe of the thigh. h 6, the head of the muscle called *Biceps*, or the fourth bender of the leg. k 6, A fleshy portion whereby it is increased. H 4, the fourth extender of the foote called *Plantaris*. l 5, A portion of the fifth muscle extending the legge, or the muscle called *Semimembraneus*. m n o 6, His head m. The beginning of his tendon o. A bosome or cavity in which the third extender of the legge doth rest. n. r 4, A fleshy part of the extender of the Legge, called *membranosus* at p His originall. p 6, the backe of the haunch-bone bare. s x 6, the circumscription of the third bender of the thigh. s 6, the insertion of the third and fourth extenders of the thigh. t 5, 6, the great and vter proceffe of the thigh. u 5, 6, A ligament going from the holy-bone into the acute proceffe of the hip. v 5, A ligament going from the holy-bone into the backe-part of the hip. y 5, the fourth nerue which is the greatest nerue of the whole legge, wherein is the tumor collected which causeth the hip-gowte. * A sinus or cavity wherein the great veyne of the Legge and the artery together, with the nerue are conueyed. 1, 2, character 6, the fourth nerue parted into two in the ham, the greater branch 1, the lesser 2. 34, character 6, the membranous beginning of the oblique ascending muscle of the *Abdomen* from the spine of the backe. 8, 9, character 6, two fleshy portions, or the fleshy pouch, and leaning to the second *Circumactor*, or compassing muscle of the thigh.

44, The first Muscle of the leg called *Longissimus*.

45, the second muscle of the legge called *Gracilis*.

45, 6, the third bender of the leg called *Seminervosus*.

45, 6, the fourth bender of the leg called *Biceps*.

45, 6, the first bender of the Legge called *Semimembraneus*.

4, the first extender of the Leg called *Membranosus*.

45, 6, the second extender of the Legge or the muscle called *Vastus externus*.

45, 6, the third extender of the leg called *Vastus internus*.

4, the fourth extender of the legge called *Rectus* or the Right muscle.

45, the first muscle extending the thigh called *Gluteus maior*.

45, the second extender of the thigh called *Gluteus medius*.

6, the third extender of the thigh called *Gluteus minor*.

5, the fourth extender of the thigh called *Iliacus internus*.

4, 6, the fifth extender of the thigh called *Triceps* or rather *Quadriceps*.

6, the hinder part of this muscle.

x 5, 6, the first circumactor or the muscle leading the thigh about, called *Obturator internus*, together with fleshy portions both above and below growing vnto it.

4, the first extender of the foote called *Gastrocnemius internus*.

4, the second extender of the foote called *Gastrocnemius externus*.

endeth into a strong and broad tendon, which is partly inserted into the roote of the greater proceffe, partly below it into the outside of the thighbone, and that obliquely.

The vse of this muscle is when it worketh all together to settle the thigh backward and to extend it directly; for if but one part of the muscle bee contracted, then the motion is not equall but more outward to this or that side.

The second extender which is called *Gluteus medius*, the middle buttocke muscle [table 32. and those that follow figure 4, 5, 8, 9, v.] lyeth for the most part vnder the first. The rest of it is couered with a membrane. It is also like the first in forme, but lesse and very liuide, as also is the third in leane bodyes, but in those that are fat especially in women wee often finde neruous fibres running through them to which fat groweth, to make the seate the softer. It ariseth with a fleshy, broad and semicircular originall, [table 32, figure 5, b i] (a little lower then the first to whose originall it giueth way) from the ridge of the haunch-bone on the fore-part and from the backe of the same haunch, and indeede it occupieth almost all the circumference of that bone; thence descending obliquely it groweth narrower by degrees, runneth vnder the forward muscle, couereth the ioynt of the hippe, and determineth into a broad, strong and membranous Tendon, [figure 5, k] which is implanted into the fore and vpper part of the great *Trochanter* or proceffe of the necke of the thigh, which it compasseth on euery side but ouerthwart. His vse is to extend the thigh and to draw it vpward and forward vnto one side, and that more manifestly then the former muscle. The fibres also of this muscle make a decussation with the fibres of the former, [table 5, u with v.]

The second.

The third Extender called *Gluteus minor*, the lesser buttocke muscle [table 32. and those that follow Figure 6, 10. &.] lyeth wholly vnder the second, and is so much lesse then it, as the second is lesse then the first. It ariseth from the backe of the haunch-bone, and from his backward and lower part where the bone of the coxendix beginneth; and his originall, (as the two former) is fleshy, thicke and semicircular. [Figure 6, q s x.] Then declining downward and forward, it cleaueth easily with fibrous ryes to the ligament of the ioynt of the hippe and becomming narrower determineth into a broad and strong Tendon, which climbing ouer the greater *trochanter* or proceffe of the thigh, is implanted into the very top of his forepart, where it is a little inuerted. [Figure 6. f.] His vse is to drawe the thigh moderately vpward and backward, and so to extend it.

The third

The fourth extender called *Iliacus externus pyriformis*, the outward haunch peare muscle [tab. 32, Figure 5, 6, and table 34, Figure 1, 3. &.] because it filleth the outward and lower cavity of the haunch-bone with his oblique position, and like a round peare. This muscle is liuide, and ariseth with a fleshy and round originall from the three lower racks of the holy-bone, or from the inner part of the sides, where sometimes it is continuall with his opposite: thence it runneth downward but fleshy and ouerthwart to the great *trochanter*; but before it touch the thigh it becommeth narrower and endeth in a round tendon, which is obliquely implanted into the greater *trochanter* or head of the thigh on the backside neare his appendix. His vse is to draw the thigh moderately vpward and backward, and so to extend it. It is also some little helpe to leade the thigh round but forward, yet more then the third muscle.

The fourth.

The fift extender is commonly called *Triceps* because it hath a threefold originall, but may better be called *Quadriceps*, for his originall or rising is fourefould. [table 31. and those that follow figure 2, 4, 6, 8, 9, 10, 11, 12, 13, 14. & p.] This is the thickest Muscle in the whole body of man, and stuffed with a wonderfull variety of fibres, insomuch that because the parts thereof doe differ among themselves in their originall, fibres, insertion, coates, and in some sort in their vse likewise, *Fallopins* saith, and so may wee also, that there are so many muscles as there are parts of this muscle, to which also the *Right* muscle which seemeth to bee a part thereof must bee referred, whose originall is seated vnder the three heads of the Muscles which make the bulke of the Legge. [tab. 32, Fig. 6. f h m] But we will here vnder exhibite his description according to *Fallopins*.

The fifth.

The thickest muscle of the body.

The first part [tab. 35, Figure 12, a part of the Muscles is at v] ariseth with a neruous originall from the vpper line of the shere-bone, and descending is inserted into a rough line of the thigh vnder the middle. Notwithstanding from his tendon proceedeth a slender portion which is vnited with the tendon of the fourth part and is inserted into the lower head of the thigh, and the inside of the knee.

The second part [table 35, and 34, Fig. 13, and 14, character 6] ariseth from the lower parts of

of

Table 33 sheweth some Muscles of the Legge and the foote.

TABVLA XXXIII.

FIG. VII.

FIG. VIII.

FIG. IX.

7, 8, The first bending Muscle of the Leg called *Longissimus*.

8, 9, the second bender of the Legge called *Gracilis*.

7, 8, The first extender of the Legge called *Membranofus*.

8, 9, The second extender of the Leg called *Vastus externus*.

7, 8, 9 The 3. extender of the Legge called *Vastus internus*.

6, A sinus or cavity upon which the ninth muscle of the thigh lyeth.

7, 8, 9, The fourth extender of the Leg called *Rectus*.

1, 2, 3. Char. 8. The originall, 2. The tendon, 3. The place where the tendon groweth to the tendons vnder it.

8, The first extending Muscle of the thigh.

8, 9, The second extender of the thigh.

9, A portion of the 5. Muscle of the thigh called *Triceps*.

8, The first bender of the thigh called *Lumbalis*.

8, The second bender of the thigh called *Iliacus internus*.

1, 2, 3, char. 8. His originall, 1, tendon 2 the place where the tendon groweth to the tendons vnder it.

7, 8, 9, The third bender of the thigh called *Glutans minor*.

8, The second externall extender of the Foote.

7, 8, The tendon of the first Muscle of the Leg neare the knee.

7, the infertions of the 1, 2 and 3 Muscles of the Leg.

8, the inner ankle. p q 7, the fleshy part of the first extender of the Legge, his large membrane at q 7, his originall. f 8, his infertion. r x 9, the beginning of the 2 extender of the Legge. r, his infertion, u, his tendon x. y 8, the tendon of the first extender of the toes at the greate toe. C 7, 8, 9, the place of the sharebone. H 7, the third extender of the foote called *plantaris*. I 7, the fourth extender of the foote called *Solietus*. K 8, the first extender of the foote called *Tibialis posticus*. L 7, 8, the first bender of the foote called *Tibialis anticus*. M 8, 9, the 2 bender of the foote called *Peronans primus*. N 8, 9, the third bender of the foote called *Peronans secundus*. O 8, 9, the first extender of the toes called *Pollicis tensor*. P 7, 8, 9, the 2 extender of the toes. p 8, 9, A portion of that Muscle which *Vesalius* maketh the 9. muscle of the foote. 10, 11, 12, char. 8, the originall thereof 10, his diuision into tendons 11, the infertion of the 9 Muscle 12. R 9, the 2 bender of the toes called *Flexor magnus*. T 7, the lower abductor of the greate toe. X 8, 9, the bone of the Legge bare T 8, 9, the vpper abductor of the toes. Z 7, 8, the muscle called *Cruicicus*. J 7, The first extender of the Foote called *Gastrocnimius internus*.

of the commissure of the share-bones where they are ioyned together. It is fleshy and broad and hath oblique fibres, descending also downward, it is implanted into the line of the thigh in the vpper part thereof.

The third part [Tab. 34. fig. 13. char. 6. fig. 14. char. 7. conferred fig. 13. 30^u. among themselves] ariseth with a fleshy, sometimes a nervous originall from the appendix of the *Coxa*, yea from the whole coxendix round about the circumference of his broad hole; his fibres are very diuers, so that it seemeth to be a double Muscle, for the vpper fibres are as it were transuerse, but many of the lower oblique. This part descending is inserted into a rough line vnder the little trochanter or head of the thigh.

The fourth part, [Table 34. fig. 12. and 13. r x y] ariseth with a nervous [figure 13. u] and then fleshy [x] originall from the appendix of the *Coxa*, which two originals forme a Muscle



Muscle whose belly is dilated into a strange breadth; [Fig. 13.] afterward running along the backside of the thigh, it endeth into a round tendon [Fig. 13, under 2] which with a slender portion of the Tendon of the first part is inserted into the inner and lower protuberation of the thigh. [three parts of this Muscle are demonstrated, tab. 36, 12, & v. where they hang down also. Tab. 34, Fig. 14, 6, 7.]

The use of this muscle although it be to lift up the Thigh and leade it to the body: yet according to the diuersity of his partes it hath diuers particular offices: for the backe part which hath right fibres, establiseth the thigh and fasteneth it vpon the ground being extended, as when a man setteth his foote to passe forward. The backe portion also of the anterior part performeth the same, but it leadeth the thigh moderately inward as it were to the other thigh, so the first part of the anterior leadeth the thigh inward and crosseth one thigh ouer another. And thus much concerning the extending Muscles, which primarily extend the thigh, and these also doe helpe it when it is moued sidelong or ledde about.

These of the
5. Muscle.

The Bending Muscles are three: The first is called *Lumbalis* [tab. 31, and those that follow Fig. 2, 8, 10, 11, 12, 14, 16, chara. 6] the Muscle of the Loynes which *Hippocrates* and *Galen* called *ΐσας*. They are placed a little obliquely into the cavity of the *Abdomen*, and when the entrails are taken forth they presently appeare in the Loynes. It is a round, fleshy, thicke and strong Muscle, and altogether liuid. It ariseth fleshy [tab. 35, Fig. 12, a] from two lower racks of the Chest, and the three vpper of the loynes: presently after it climbeth ouer the rest of the racks of the Loynes, and descending fleshy by the haunch-bone [from a to b] it runneth a little obliquely and something outward about the share-bone, and so determineth into a strong and round Tendon which is inserted on the fore side at the vpper part of the lesser head of the thigh. His use is strongly to drawe the Thigh vpward and to bend it inward. And because the tendon of this Muscle should be securely conuayed, not hurt by the hardnesse of the bone, nor yet erre or wander out of his way, there is a *sinus* or cavity insculped in the share-bone which is couered ouer with a membranous, smooth and slippery Ligament arising out of the bone. And because the kidneys lie vpon this Muscle ouer which a notable nerue is disseminated; hence it commeth to passe that those that are troubled with the stone in the Kidneyes doe finde a *stupor* or sleepinesse on the Thigh on that side the stone is on.

The first bending
muscle.

The second Bender is called *Iliacus internus* the inward haunch-Muscle. [Table 31, fig. 2. & Tab. 33, fig. 10, 11, 12, 16, T] At the lower part it toucheth the former Muscle [tab. 35, fig. 11, 12, T, as farre as c] and occupyeth all the inner cavity of the haunch-bone. From thence as it were out of a semicircle it ariseth fleshy and broad and by degrees becommeth narrower and thicker, and descending forward about the vpper part of the *Coxendix* it is implanted with a round tendon [Ta. 34, fig. 14, T] into the lesser head of the thigh like as the former, but somewhat lower then the first bender. His use is together with the first Bender to lift the Thigh vpward and so to bend it, but this Muscle mooueth it lesse inward. And whereas it is carried about the *Coxendix*, the bone hath in it a smooth and slippery cavity for the better conueying thereof, which cavity where the Muscle bendeth is liuid, nervous and strong, the better to defend it selfe against the hardnesse of the bone.

The 2 Bender.

The third Bender [tab. 31, and those that follow, Fig. 1, 7, 10, 11, 12, v] is also liuid, and ariseth broad and fleshy from the Line of the share-bone, hard at his gristle and runneth obliquely within the first extender, so that some haue accounted it for a first part of the same first Muscle and so determineth into a short, broad and large tendon which is inserted at the inside of the Thigh ouer against the lesser head and runneth out vnto the backside. His use is to leade the Thigh vpward and inward very strongly and so to crosse one Thigh ouer another. And so much for the benders of the Thigh.

The 3 Bender.

The first compasser which is called *Obturator externus* the outward filler [table 35, Figure 12, 14, 16, e] lyeth vnder the former and filleth vp on the outside all the hole which is before in the share and the haunch-bones. The forme of it is like a Peare as was the fourth extender. It ariseth fleshy and broad from the circumference of the foresaid hole, and on the fore side is liuid. It runneth ouerthwart and behinde by the hip ioynt away and the necke of the thigh, there it is by degrees angustated and determineth into a strong and large tendon, which is implanted into a cavity of the greate *trochanter* or the head of the thigh. His use is to turne the thigh inward, *Laurentius* sayth outward.

The first compasser.

The second compasser *Obturator internus* the inward filler [Table 31, and those that fol

The 2 compasser.

14, A tendon made of three muscles of the foot. Tab. 14. Sheweth the Muscles of the thigh and of the foote.

14, The beginning of the tendon of the first *Peroneus* out of the middle of his body.

14, The tendon of the second *Peroneus* reflected to the outward ankle.

13, the fourth bending muscle of the leg called *Biceps*, hanging downe.

13, the fifth bender of the leg called *semimembranous* hanging downe.

15, A ligament in the sole of the foote serving in stead of the broad tendon.

13, the second extender of the legge called *Vastus externus*.

13, 14, The third extender of the legge called *vastus internus*.

13, 14, An acute Ligament going from the holy bone into the proesse of the hip bone.

14, the muscle called *popliteus* moving the legge obliquely.

13, A portion of the third muscle extending the thigh.

14, the fourth extender of the thigh or a portion of the *Illiack* muscle.

13, 14, the fifth extender of the thigh called *triceps*.

13, Another part of the fifth muscle.

13, the first bender of the thigh called *Lumbalis*.

13, The 2 bender of the thigh or a tendon of the internall *Iliacke* muscle.

14, the first compasser of the thigh called *obturator externus*.

13, 14, the second compasser of the thigh called *obturator internus*.

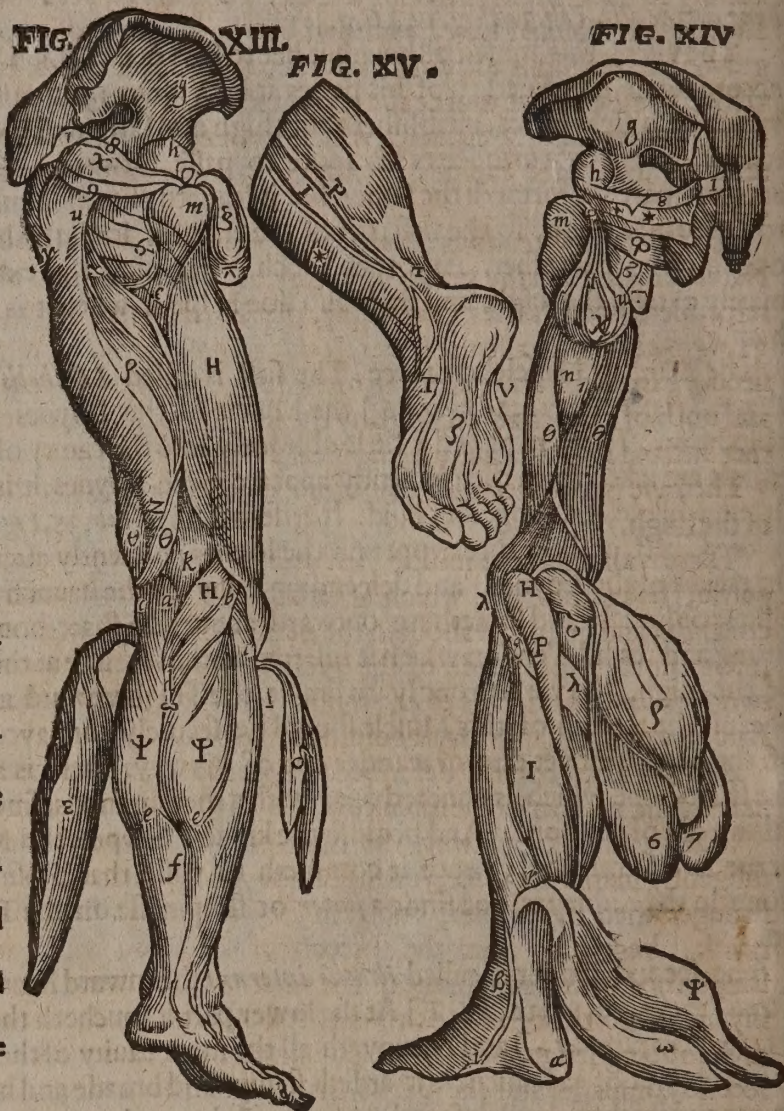
13, 14, the second extender of the foote called *Gastrocnemius externus*.

13, the beginning of the two extenders of the foote.

13, their fleshy beginning.

13, Their contiguity or meeting together. 13 the swelling of both the calues. 13, the beginning of the Tendon of these muscles. 13, 14, the backe of the share-bone without flesh. 13, 14, the head of the thigh bone compassed and defended with a membranous Ligament. 13, The place of the thigh bone without flesh. 14, The rumpe bone without flesh. 13, 14, The exterior and greates proesse of the thigh. 14, A rough line of the thigh whereinto is inserted the first muscle of the thigh called *triceps*. 14, The bone of the legge and the outward head of the thigh bored. 14, The tendon of the third extender of the foote. 14, The beginning of the fourth extender of the foote. 14, The insertion of the tendon of the first and second Muscles of the foote. 14, The tendons of the tenth muscle, of the thigh reflected to the haunch bone. 13, the nervous head of the backpart of the first extender of the thigh. 13, The fleshy head of the same Muscle. 13, Carrying the proportion of a mouse. 13, The tendon of the first part inserted into the inner tendon of the thigh. 6, Char. 13, the third part of the fifth Muscle. 7, Char. 14, another part of the fifth muscle. 8, 9, Char. 13, two fleshy portions or the fleshy pouch which adhereth to the second compasser of the thigh. 13, 14, the third extender of the foote called *Plantaris*. 14, 15, the fourth extender of the Foote called *Soleus*. 15, a cavity betwixt the tendon of the forenamed muscle and the other. 15, the place of the bone of the leg without the flesh. 15, the lower abductor of the greates toe. 15, the abductor of the little toe.

TABVLA XXXIV.



low, Figure 2, x a c f, fig. 5, 6, above char. 9, f 13, 14, x] lurketh in the bowle of the hanch-bone, occupyeth the inside of the forenamed perforation, is stronger then the former, and distinguished there-from by a membrane to which it groweth. It ariseth fleshy and broad from the circumference of the perforation on the inside and appeareth notable liuid having three lines, or inscriptions. Afterward it is by degrees contracted or straightned, [table 31, figure 2, a c. unto f] and runneth ouertwart about the coxendix outward, [Table 34, Figure 13, x] and above the cavity which is formed like a pully it hasteneth to the great trochanter where it is reflected; the reflected part being fleshy and that which toucheth the cavity nervous. At this cavity it is increased with three round Tendons [table 34, figure 14, f 14] in the very reflection; which tendons beeing a little separated one from the other doe

doe passe forward, and when they are past the cavity on the backside they are againe collected and make one nervous tendon, [tab. 43, fig. 13. X. 8, 9] which tendon is led ouerthwart and together with the first compasser is inserted into the hinder cavity or sinus of the great *Trochanter* or head of the thigh, and into his roote. And this was Natures counsell determining to adde strength to this muscle; for if it had beene wholly fleshy, in his reflection and motion it would haue beene hurt by the hardnesse of the bone. Wherefore also there groweth to the Sinus a strong membranous ligament which is smooth and lined ouer with a viscid humor for the more easie circumaction of the muscle. But this Sinus hath appearing in it two lines lightly eleuated, which running ouerthwart doe diuide the three forenamed tendons into three cavities; so that in this one cavity euery tendon hath a peculiar Sinus.

And least these tendons should slip out of the cavity of the bone after they are reflected, Nature created a fleshy purse wherein the Tendon of this muscle is placed, which purse resembleth two Muscles, [tab. 38, fig. 16, xx] one vpper and another lower. The vpper [tab. 32, fig. 6, char. 8] as also the lower, [tab. 31, fig. 6, 13, 14, char. 9, fig. 16, x] doe arise fleshy and slender; from the acute proesse of the haunch-bone the vpper, the lower from his appendix and both of them doe accompany the second compasser euen to his insertion and are together inserted into the cavity of the great *Trochanter*.

Their vse is together with the second compasser to helpe the circumaction or compassing of the thigh.

There is also another muscle first described by *Fallopins*, which lyeth vnder the foresayde purse, [tab. 34, fig. 14, *] which ariseth short and very slender from the backe-part of the coxendix and being led about to the outside of the thigh, is with a strong and round tendon inserted into the backside of the great *Trochanter*, or into that space which is betwixt the two *Trochanters* or heads of the thigh. His vse is to leade the thigh in compasse backward. And this muscle haply may be diuided into two.

Arantius alter he hath described this muscle found out by *Fallopins*, hee addeth another, so making the number of the muscles of the thigh to bee a full Iury in these words.

When you haue cut away the muscles which bend the legge from their originals, if you diligently marke the place, you shall finde vnder the eleuenth muscle a twelfth, which is much stronger then the former, but lyeth very deepe. It hath an originall opposite vnto the eleuenth, beginning from the forepart of the share-bone where it is perforated, and it is distinguished with a membrane of the nature of a Ligament. This originall, sayeth hee, is fleshy and almost orbicular or round. It degenerateth into a strong and round tendon. This muscle being ledde about like a semicircular to the outside of the thigh, together wth the second compasser and the purse, that is, with the tenth and eleuenth muscles serue to guide the sphericall or round motion of the thigh.

CHAP. XXXIX.

Of the Muscles of the foote.



THE Foote is mooued two wayes directly and to the sides; directly also or in length two wayes: for it is either extended backward when it is led out of his transuerse position, a little obliquely toward the earth (and that by the helpe of five Muscles placed in the back-part, together with the second and third benders of the toes) as when we walke or dance: or it is bent forward by three muscles, to which may be added that portion of the Muscle which some make the ninth but we account it for part of the second muscle which stretcheth the toes: and these are placed together with the first and second extenders of the toes on the forepart but the outside of the legge, for the inside of the legge euen vnto the Calse is without flesh. This motion is not so strong as the former, and therefore doth not stand in neede of so greate muscles.

The Foote is also mooued to the sides and so a little compassed; which motion because it is very weake, hath not any particular or priuate muscle allotted thereto, but it is ledde to the outside by the anterior Muscles and to the inside by the posterior. The extending Muscles therefore of the foote are five, and the benders three.

The first extender is called *Gastrocnimius internus* [Table 31. and those that follow figure

The purse.

like two muscles.

Their vse.

Fallopins his 11. muscle.*Arantius* his 12. muscle.

The motions of the foote.

His muscles.

The first extender.

1, 2,

1, 2, 3, 4, 13, 14, ^p] the internal Calse-muscle, ariseth from the inner head of the thigh about the knee as it were with a double originall. The one vpper [Fig. 13, b] which is fleshy and broad: the other lower and vter which is neruous and liuid [fig. 13, c] The first descending a little vnder the ioynts of the knee is confounded with the second, and both together make a fleshy and thicke muscle which about the middle part of the Legge after it hath formed the inner part of the Calse [fig. 13, above e] becommeth narrower and endeth into a broad [fig. 13, f] and neruous tendon, in the middest whereof notwithstanding a fleshy portion sheweth it selfe running a little way therein, which being vnited with the tendon of the next Muscle following, [fig. 13, and 14, w] is in Apes inserted into the heele, but in men it groweth to the 4 extender of the foot; [fig. 14, 7] in somuch that euen to the very heele it cannot be separated there-from. And these three muscles doe draw the heele vppward and backward and doe fasten the foote vpon the earth, or reflect it downeward and backward.

The second
extender.

The second extender is called *Gastrocnimius externus*, the outward Calse-muscle [table 31, and those that follow fig. 3, 4, 10, 13, 14, w] It proceedeth from the vter head of the thigh, and is in all parts like the former, sauing that the first descendeth fleshy lower, which also may be

Table 35. Sheweth some Muscles of the Thigh, the Legge, the Foote and the Toes.

TABVLA XXXV.

FIG. X.

FIG. XI.

FIG. XII.



minor. p 10, 11, 12, the first muscle of the thigh called *Triceps*. o 10, 11, 12, the sixth muscle of the thigh called *Lumbalis*. o char: 12, the forepart of the fifth muscle of the thigh. r 10, 11, 12, the seventh muscle of the thigh called *Hiacin Internus*. u 10, 11, 12, the eighth muscle of the thigh. o, 12, The first Compasser of the eight called *Obturator externus*. a 10, the second extender of the foote called *Gastrocnimius externus*. A, 11, 12, the holy-bone. H 10, the second extender of the legge called *Vastus externus*. M 10, 12, the second bender of the foote called *Peroneus primus*. N 10, 12, the third bender of the foote called *Peroneus secundus*. O 10, the first extender of the toes called *Pollicis tensor*. T 11, the lower abductor of the great toe. V 10, the abductor of the little toe. X 10, the bone of the leg without flesh, with the ligament which runneth betwixt it and the Brace. Y 10, 11, the vpper abductor of the toes. Z 20, makes the muscles called *Craecus*. z 11, 12, the first muscle of the backe called *Quadratus*.

a 10, the spine of the haunch-bone bared from the muscles.
b 10, the greater exterior proceffe of the thigh.
a b, 12, the originall of the first extender of the thigh at a, his tendon at b.
c 12, the share-bone bared.
f, 12, the thigh-bone without flesh.
g, 12, the backpart of the whirle-bone regarding the ioynt, the tendons grow to the fore side.
b, 12, the tendon of the second extender of the leg called *Vastus externus*.
i 12, the insertion of the fourth bender of the leg called *Biceps*.
k 12, the connexion into one of the tendons of the 7, 8, and 9, muscles.
l 12, the tendon of the ninth muscle of the leg called *Rectus*.
m 12, the forepart of the leg bone without flesh.
u 10, The originall of the second bender of the foote.
n 12, the forepart of the Brace bared.
o 12, A ligament placed betwene the bone of the leg and the brace.
o 10, the outward ankle.
p q 10, the body of the second bender of the foote before and behind.
r 10, the beginning of the tendon of this muscle arising out of the middest of his body.
s 10, the tendons of the third bender of the foote reflected to the outward ankle.
y 10, the originall of the third extender of the legge called *Vastus internus*.
d 10, the fourth bender of the legge called *Biceps*.
o 10, 11, 12, the third extender of the legge called *Vastus internus*.
z 10, the third extender of the thigh called *Gluteus*.

per-

perceiued before Diffecion in those bodies that are musculous or fleshy. This Muscle not farre from his originall is ioyned with the first with fibrous ty es and groweth thereto at the middle of the Leg: [tab. 13, d] and therefore *Sylvius* and *Laurentius* call them *Gemelli* or the *Twins*. This muscle when it hath formed the ourward part of the calfe endeth in a tendon which is so mixed with a Tendon of the former that it seemeth to bee but one Muscle to *Columbus* and *Archangelus*, for they haue but one tendon and one implantation, and these two together with the fourth doe make the pulpamentum, the pulpe or calfe of the Legge. But because in the direction of the Legge those heades are returned backward and so compressed; least any offence should thereby proceede, each originall hath a small sidebone ioyned to it to receiue the violence and abate it in their smooth and slippery Surface which standeth vp from the substance of the Muscles, and doeth regard the smooth superficies of the heades of the thigh whereupon they leane. These Side-bones also doe keepe the Muscles from attrition and laceration and adde strength vnto them.

The side bones.

The third Extender is called *Plantaris* or the Muscle of the palme or treade [table 13, and those that follow, fig. 7, 14, 16, H] It lurketh in the hamme vnder the former and is very slender. It ariseth with a fleshy and narrow originall from the outward head of the thigh neare the ioynt, but descending obliquely from the externall toward the internall part it is dilated: yet the fleshy part thereof is small, for presently vnder the knee it determineth into a very slender neruous and exceeding long tendon [tab. 14, 15, 16, p Tab. 31, fig. 2, and 4, H] so long that among all the round Tendons of the body there is none longer. This tendon is spread ouer the Muscle following, whereto in his progresse it is strongly tyed and implanted into the inside of the heele behinde. Sometimes it groweth broade and by the sides of the heele is spent into the whole skinne of the palme or plant of the foote, as the palme muscle in the hand. But when this Muscle (as it is with the muscle of the palme of the hand) is wanting, then his tendon is substituted by the second bender of the toes. His vse is to writhe and turne the foote inward.

The 3. extender.

The fourth Extender is called *Soleus* or the Muscle of the Soale. [Tab. 31, and those that follow, fig. 2, 7, 14, 16, I] It is the greatest and the thickest Muscle of the foote and lyeth vnder the former Muscles, and where the two first leane vpon it, it is liuid like them. It ariseth neruous and stronge from the backpart of the *Fibula* or Brace, where it is articulated with the *Tibia* or Leg-bone, and becomming thicker it exceedeth in bredth both the bones of the Leg, but about the middle it is by degrees angustated or straytned, and a little aboue the heele degenerateth into a thicke and very strong Tendon, which on the foreside is nourished or encreased with a substance like flesh farther then it is on the backside, and being vnited with the tendon of the first and second Muscles [tab. 38, fig. 16, p 1] is implanted very strongly into the backpart of the heele, where for this Muscles sake it is depressed and rough. His vse is to extend the foote and firme it vpon the ground.

The 4. extender.

But because the bone of the heele standeth out beyond the rectitude of the bone of the Leg, this Tendon a little before his insertion departeth from the Legge [fig. 15, *] and maketh an empty cavity, through which the Butchers peirce their Cammockes to hang the beast vpon in the shambles; for in the whole body there is no Tendon stronger then it. *Hippocrates* called it *Chorda*, where hee saith that vpon the fracture of the heele there follow dangerous Feuers full of Hiccocks and convulsions.

The fift & last Extender is called *Tibialis posticus*, the hinder Leg-muscle. [tab. 31, fig. 2, 7, 18, 19, K.] It lyeth next to the bone betwixt the Brace & the Legge vnder two Muscles which bend the Toes. It ariseth from the two foresaid bones [Fig. 18, L] and presently becommeth fleshy and broade, descending fleshy vnto the extreame appendix of the Legge, vpon which bone for the most part it lyeth through his length: it cleaueth also to a Ligament which lyeth betwixt these two bones, from whence haply his originall gathereth strength, and in the middle of the Leg-bone from the inside onely it produceth a round neruous, and strong Tendon which tooke his beginning a little within the substance of the Muscle. This tendon creepeth through a cavity grauen in the Leg-bone neare the inner ankle vnder the transuerse Ligament; and obliquely attayneth vnto the soale of the Foote vnder the Muscles which occupy the plant [tab. 36, Fig. 18, 19, m] or Treade, and is strongly inserted into the proceffe which is on the lower side of the bone of the *Tarsus* or After-wrist of the foote which is neare the Cube-bone, which proceffe was onely created for his insertion. His vse is to draw the foote inward, it helpeth also the motions of the first, second and fourth Muscles, and therefore moueth the foote to the earth, and sometimes leadeth it backward, when we would stand vpon our tip-toes as we say. And thus much concerning the extending

The 5. extender.

tending Muscles of the foote on the backpart thereof. It followeth that wee should intreat of his bending or *anterior* Muscles which we sayd are three.

The 1. bender.

The first Bender is called *Tibialis anticus*, the forward Leg-muscle, [tab. 31, and those that follow, Fig. 1, 7, 8, L] because it cleaueth to the forepart of the Leg-bone at his outside.

It is the larger of the Benders and very nearly resembleth a Snake and lyeth vpon the Muscles of the Toes. It ariseth acute or sharpe neare to the *Brace* where it is articulated with the Leg-bone. Presently it is dilated, and on the inside of the Leg-bone it is ioyned to an acute line and becomming streighter by degrees vnto the middle of the Leg-bone determineth farre aboue the foote into a round, neruous and strong tendon, [Fig. 2. and 18. n] which tendon also sometimes riseth vp vnder the skinne, and growing from the lower appendix of the leg and the brace vnder the transuerse Ligament attaineth to the inside of the foote, and conuayed in a reasonable open cauity aboue the vpper part of the After-wrist or the *Tarsus*, is wholly inserted into the inner proceffe of the bone of the wrist of the foote which sustayneth the great toe. His vse is to bend the foote it selfe, and to draw it forward and vpward. This Muscle as also that that went before, especially in that part where they are reflected vnder the wrist and After-wrist of the foote, haue a gristle and feede-bone allowed them by Nature to prevent their attrition.

The 2. bender.

The second bender called *Peroneus primus*, or the *first brace muscle*, [tab. 31, and those that follow Fig. 1, 3, 8, 9, 10, 12, 16, 18, 19, M] is in his whole progresse ioyned with the outside of the precedent muscle, and by it selfe is repressed in the outside of the Leg. It ariseth fleshy and neruous [Figure 10, n.] from the vpper and outward part of the appendix of the *fibula* or *brace*, and becomming fleshy it paceth along the same, cleauing som epart to his side: departing from the *brace* it is on the outside liuid, but on the inside fleshy and ruddy, and being conuayed a little below the middle of the *brace* between two fleshy sides [Figure 10, p, q] out of the very middle of his body produceth an exceeding strong tendon [Fig. 10, r] which is increased in the inside on either hand with flesh, which tendon becomming by degrees without flesh and reflected obliquely toward the backside of the appendix of the brace, and leauing the outward ankle naked [Fig. 10, o] being inuolued in a transuerse Ligament which proceedeth from the brace into the heele and the bone called the *cockall* or the *talus*, it passeth the fissure of the same outward ankle, and being very much reflected vnder the *plant* [tab. 36, fig. 19, t u] is inserted brode into the roote of that bone of the wrist of the foote which lyeth vnder the great toe. I say into the proceffe which is on the outside of that bone: sometime into that bone vpon which the middle toe resteth.

His vse is to leade and bend the foote vpward and outward. But this Tendon passeth in the middest betwixt the bones and the Muscles of the plant or soale of the foote [figure 19, t u] least if it should walke onely vnder the skinne when it is contracted vpward it might compresse the Muscles seated in the soale and hinder their functions. So also in the lower part of the *cake-bone*, there is a cauity somewhat brode but not deepe, smeared ouer with a viscid humor and compassed with a slippery Ligament, at which the tendon is compassed not round lest it should fall thereout, but dilated [table 36, figure 19, t] that so it might more firmly be reuolued at the shallow cauity. Againe the Tendon in the same place is so hardened that it is like a grystle, yea sometime so bony as if it were a feede-bone, that it might better and more readily auoyde the violence of the bending or flexion at an acute angle.

The third.

The third and last bender called *Peroneus secundus*, the second *brace muscle*, [Table 31, and those that follow figure 3, 8, 9, 10, 18, 19, N] is hid vnder the former (his tendon excepted) and is like thereto. It ariseth also with a long originall from the same appendix of the brace, and being fleshy descendeth downe the same brace to which it is tyed, and when it hath ouercome the middest thereof, it departeth into a round Tendon which is reflected toward the backside of the brace and is fastened to the foreside of the Tendon of the second bender, and lying vpon a cauity ingrauen in the backside of the appendix of the brace and compassed with the transuerse Ligament it descendeth forward: but at the vtter and lower part of the ankle it is againe reflected, diuided, and becommeth forked, [tab. 35, figure, 10, f] lest it should bunch vp too high, and is implanted [table. 36, figure 19, x] very strongly with a double and broade insertion into the proceffe of that bone of the wrist of the foote which sustains the little toe. His vse is to leade and bend the foote outward.

To

To these eight Muscles of the foote *Vesalins* and *Falopius* add a ninth [tab. 33, fig. 8, 9, p] which *Banishine* taketh rather to be a part of the second extender of the toes [tab. 33, fig. 7, 8, 9, p] then a particular muscle of it selfe. And thus much of the muscles of the foote.

Falopius: ninth muscle.

CHAP. XL.

Of the Muscles of the Toes.

He foure toes of the foote are mooued almost with the same motions that the fingers of the hands are mooued with. But the great or thumbe-toe is not led after the same manner with the thumbe of the hand, that is, with a flexion opposite to the other fingers, but his first ioynt is bent after the same manner with the first ioynts of the rest of the toes, because his position is in the same order. The toes therefore are mooued directly or sidelong. If directly, then eyther they are bent toward the earth, euery ioynt being mooued apart, and that either directly onely, as the second and third ioynts of the foure toes, and the second of the thumbe or great toe; or directly and obliquely together, as the first ioynts of all the five toes. If they be extended, the extension is made directly or in a right line, and so all the ioynts are mooued together. If they moue to one side that motion is eyther outward, as when the foure greater are led to the little toe, and the little toe led from the rest: or inward when the thumbe-toe is ledde from the rest and the foure lesser toes mooued toward it. All these motions are absolued by three and twenty muscles, whereof some are seated in the leg, that is to say, part in his fore part and part in his back part. Others are placed in the foote it selfe, properly so called.

The motion of the toes.

Their muscles 23.

The first Muscle of the toes is called *Pollicis tensor*, the extender of the great toe or the first extender, [tab. 33, fig. 8, 9, p] it is seated in the fore side of the legge, together with that which next followeth at whose inner side it lyeth.

First.

It ariseth fleshy from the outside of the legge where the bone of the leg or the *Tibia* departeth from the *Brace* or the *Fibula*. After it descendeth and groweth in his whole passage to a membranous Ligament which commeth betwixt the leg and the *Brace* bones and so attaineth vnto the fore side of the leg; thence creeping vnder the transuerse Ligament [tab. 31, fig. 1, char. 2] and ouer the foote, it is inserted into the vpper part of the whole length of the great toe to extend it. Sometimes the tendon is diuided into two, one of which is inserted into the last ioynt of the great toe, the other into the wrist of the foote to bend it. And this latter tendon in some bodies seemeth to be a distinct muscle. But that saith *Columbus* is very rare.

The second extender [tab. 31, and those that follow fig. 1, 3, 7, 8, 9, p] is placed in the fore part of the leg, but lurketh vnder the first muscle of the foote. It ariseth with an acute and neruous originall [tab. 33, fig. 8, char. 10] which presently becommeth fleshy, from the top or extremity of the appendix of the leg, where vnder the knee it is fastened to the *Brace*; thence it descendeth directly along the *Brace* and about the middle thereof it casteth off from his outside a fleshy portion, [tab. 31, and those that follow fig. 8, 9, p] which portion descending downward, maketh that muscle which *Falopius* calleth the ninth Muscle of the foote: presently falling yet lower vnder the transuerse Ligament which is on the fore side of the leg, [tab. 31, fig. 1, char. 2] to which it adhereth; at the end of the *Fibula* or *Brace* it degenerateth into a tendon, [tab. 33, fig. 8, char. 12] which tendon before it passe the transuerse Ligament is diuided into foure round tendons separated and conueyed through the backe of the soale vnto the foure toes, (beside the great toe) which run through their whole length, and becomming broader are inserted into their vpper parts. Their vse is to extend the three ioynts of the foure toes together.

Second.

Fleshy parts.

The third muscle of the toes is called *Pollicis Flexor*, the bender of the great toe, or the first bender, [tab. 31, and those that follow, fig. 2, 7, 16, 17, 2,] and is seated with that which next followeth in the backpart of the leg vnder the muscles, which make the *Palp* or *Calf*, and it is almost altogether fleshy.

Third.

It ariseth [figure 16, character 13,] from the backe-part at the connexion or coniunction of the *Brace* with the Legge-bone, where from his inside there issueth a round Tendon, [Figure 16, 17, character 14,] which may bee scene manifestly to haue his

originall out of the flesh, [Table 36. figure 16, a] which tendon passeth obliquely vnder the Ankle at the inside of the heele, where a cavity is engrauen for it, and where also it is couered with a transuerse Ligament: thence it inclineth vnder the plant or treade of the foot, at which place sometimes it transmitteth certaine small portions into the tendons of the third muscle with which it is commixed, [fig. 16, char. 19] and when his especiall tendon is receiued by the transuerse Ligament, it is inserted with a broade implantation into the second bone of the great toe after it hath passed the length of the first, which second bone it bendeth. Sometime vnder the soale it is diuided into two tendons the largest whereof it transmitteth to the great toe, the lesser vnto the next, and then the second bender is diuided onely into three tendons and no more. This tendon before it is inserted into the second bone of the great toe hath a great seede-bone set before it with a slippery and smooth surface.

The fourth.

The fourth Muscle of the Toes or the second Bender which is called *Digitum flexor magnus*, the greates Bender of the Toes [tab. 36. fig. 16, 17, 18, R] lyeth neare the former and lea- neth rather vnder the Legge then vpon the Brace-bone [tab. 36. fig. 18, rather A, then B.]

It ariseth fleshy from the Leg-bone vnder the hamme [fig. 19, char. 8] and descending almost to the heele, it produceth from the inside a round tendon [fig. 16, char. 7] which passing along vnder the inner ankle, and in a peculiar cavity of the heele [fig. 19, D] and vnder the transuerse Ligament which groweth from the appendix of the Legge, it runneth vnder the tendon of the third Muscle in the soale of the Foote with which it maketh a decussation [fig. 17, betwixt the 17, and the 15, characters] and in the middle of the foot is deu- ided into foure tendons, [fig. 17, char. 18] which being bound with Ligaments and passing through the Section or diuision of the Tendons of the subsequent muscle are inserted broad according to the length of the bone into the third ioynt of the foure Toes. The vse of this Muscle is to bend those foure toes, to contract them strongly and to leade them one to ano- ther.

The fift.

The fift Muscle is also the third bender. [tab. 36. fig. 16, 17, S] It is seated vnder the mid- dle of the soale and ariseth with an originall mixed betwixt a neruous and a fleshy from the lower part of the heele-bone, and the forepart of his protuberation. Presently after his originall it becommeth fleshy and passeth toward the Toes, being by degrees dilated or spread abroad according to the forme of the foote. At the middest whereof it is deu- ided into foure fleshy parts; [tab. 36. fig. 16, char. 21] which parts being separated doe each of them produce a round tendon which are receiued at the roote of the first ioynt by the trans- uerse Ligament, and being deu- ided (as it is in the hand) with a long section each of them growing broad, are inserted into the second bone of the foure Toes.

The vse of this Muscle is to bend the second ioynt of the foure Toes. There also grow- eth very strongly a broade tendon [tab. 34. fig. 15, 2] vnder all the fleshy substance of this Muscle, which serueth instead of a broad tendon of the hand, and sometimes is the tendon of the third Muscle of the Foote which is called *Plantaris*. This tendon is of exquisite sense the better to forewarne vs vpon the inst of externall iniuries.

[Table 36. is the same with 31.]

The sixt.

The sixt Muscle is called *Abductor pollicis inferior*, the lower backe-leader of the great Toe. [tab. 31, and those that follow, 1, 2, 7, 11, 16 g] It lyeth on the inside of the Foote throughout the length thereof, and resembleth the fashion of a Mouse. His originall is neruous from the heele on the inside neare the muscle foregoing, and becomming fleshy it is fastned to that bone of the wrist of the Foote which supporteth the great Toe, and degenerateth into a round tendon which is implanted on the outside into the first bone of the said great Toe to leade it from the rest.

The seauenth.

The seauenth Muscle is called *Abductor minimi digiti inferior*, the lower backe-leader of the Little Toe. [tab. 31, and those that follow, fig. 3, 4, 15, 16, V] It is situated in the exter- nall part of the Foote and ariseth with a neruous originall from the vter part of the Heele where there is a protuberation, and becomming fleshy it expresseth the forme of a perfect Muscle, and is affixed to that proceffe of the wrist-bone which sustaineth the little Toe, and determineth into a round Tendon which is infixed into the outside of the first bone of the little Toe to leade it from the rest.

These three are couered or inuested by a thicke and broade tendon as it was in the palme of the hand.

The 8, 9, 10, and 11.

The 8, 9, 10, and 11. Muscles, or the 3, 4, 5, and 6. Extenders, called also *Lumbricales*, the

Table 38. sheweth the Muscles of the Foote, and the Toes thereof. But the 18. and 19. Figures shew the right Foote as did those two in the 34. Table, but here it is more bared from the Muscles.

TABVLA XXXVIII.

a 16, The backe of the hanch bone bare.

b 16, A membranous ligament occupi-
ing the greate perforation of the share-
bone.

m 18, The beginning of the fift exten-
der of the Foote at *l*, his tendon at *m*
18, and 19.

n 18, A portion of the Tendon of the first
bender of the foote.

p 16 The tendon of the 3. muscle exten-
ding the foote.

r 19, the 2. bender of the foote or the
first *Peroneus* reflected in the foote.

xx 16, two fleshy partes compassing
the Tendons of the tenth muscle of
the thigh.

x 19, The insertion of the 3. bender of
the foote.

A 18, 19, The bone of the leg.

B 18, 19, the *Brace*.

CD 18, the bosome or cavity of the ten-
dons of the 2. and 3. muscles of the
toes.

E 18, Small bones neare the first ioynt of
the greate toe.

F 19, a ligament going betwixt the bones
of the leg and *Brace*.

H 16, the 3. extender of the Foote.
called *Plantaris*.

I 16, the 4. extender of the foote called *Soleus*. *K* 18, 19, the first extender of the foote called *Tibialis posterior*. *M* 16, 18, 19, the second bender of the foote or the first *Peroneus*. *N* 18, 19, the 3. bender of the foote or the second *Peroneus*. *Q* 16, 17, 18, the first muscle bending the toes of the foote or the bender of the great toe. *R* 16, 17, the second bender of the toes or their greate bender. *S* 16, 17, the 3. muscle bending the toes or their other bender. *T* 16, the lower *Abductor* of the greate toe. *V* 16, the *Abductor* of the little toe. *X* 17, 18, the foure muscles called *Lumbricales*. *Z* 16, the muscles called *Interossei* or the bone bound muscles. *a* 16, the muscle mouing the Leg obliquely called *Popliteus*. *o* 16, the first bender of the thigh called *Lumbalis descendens*. *r* 16, the 2. bender of the thigh called *Iliacus internus*. *s* 16, a por-
tion of the first compasser of the thigh. *4* 16, the first extender of the foote called *Gastrocnimius internus*. *o* 16, the second extender of the foote called *Gastrocnimius externus*. ** 16*, the thigh bone bare. 1, 2, 3, Char. 19, three *Sinus* or bosomes made to carry three tendons. 3, char. 16, a ligament hanging from the ioynts of the Toes, doing the office of the broad tendon. 4, 5, Char. 16, the originall of the muscle of the ham called *Popliteus* at 4, his insertion at 5. 13, char. 16, the originall of the first bender of the toes. 14, 15, Char. 16, 17, the tendon of that muscle at 14, his insertion at the greate Toe 15. 16, char. 16, the be-
ginning of the second bender of the toes. 17, char. 16, 17, the tendon of the same arising there. 18, char. 17, the tendon diuided into foure parts. 19, char. 18, the commixtion of the tendons. 20, 21, Char. 16, the third bender of the toes, his originall from the heele at 20, his diuision into foure tendons at 21, 22, char. 16, 17, 18, a fleshy portion growing to the bones of the foote at the great toe.

Figure 20. sheweth the Ligaments growing to the ioynts and the Bones of the Leg & the Thigh.

AB, The thigh bone at *A* his vpper head at *B*. *CD*, the 2 lower heads thereof. *E*, the bone of the Legge. *F*, his vpper protuberation, *G*, the lower *Sinus* or cavity. *H*, the inner ankle. *I*, the *Brace-bone* called *Fibula*. *K*, the vpper ankle. *L*, the vpper, a round ligament of the head of the thigh. *L*, the lower a muscle in the calfe or the fourth of the Foote. *MM*, a ligament compassing the vpper ioynt of the thigh. *N*, A ligament growing to the greater proceffe of the thigh. *O*, A Ligament affixed to the lesser proceffe of the thigh. *PP*, a ligament inuoluing the ioynts of the knee. *QR*, a ligament set to the vtter and inner side of the knee. *S*, a ligament coupling the protuberation of the leg-bone marked with *F* and the thigh together. *TV*, a ligament binding the leg-bone and the *Brace* together above and below. *X*, a membranous ligament fastening together the Legge and the *Brace*. *YZ*, a transuerse ligament gathering the nerues. *a* a tendon made of three muscles of the foote and inserted into the heele. *ab*, liga-
ments ioyning the heele to the Leg and the *Brace*: from the bone of the leg to the heele at *a*, from the *Brace* to the heele at *b*. *cd*, A gristly Ligament running from the inner Ankle into the inside of the *Talus* at *c*: another ioyning the *Brace* to the *Talus*.

the wormy Muscle [tab. 36. fig. 17. 18. x] are seated vnder the soale of the Foote, and arising from the Ligament which compasseth the foure tendons of the perforating Muscle or the second Bender, are implanted round and small into the Tendons of the Muscles extending the Toes, to extend or stretch forth their second or third ioynts. These muscles for their farther strength receiue a fleshy portion from the heele, which lyeth vnder the three forenamed Muscles.

The twelfth.

The twelfth Muscle called *Abductor digitorum superior*, the vpper backe-leader of the toes, [tab. 31. fig. 1. 8. 9. 10. 11. T T] is seated in the vpper and gibbous part of the Foote. It is a broad and slender Muscle, and ariseth fleshy from the Ligaments which are at the heele & the bone called *Cubiforme* or the Dye aboue the wrist and after-wrist of the Foote, and running obliquely toward the toes is diuided into foure fleshy parts euery one of which make a round tendon. The greatest of which is inserted into the vtter side of the great toe toward the height thereof. The second of the next toe. The third of the middle toe, and the fourth of the fourth toe. Sometimes also but rarely a small part is lent vnto the little toe.

The vse of this muscle is to moue the toes to the sides and to leade them backward and outward. But when it hath onely foure tendons, then the tendon belonging to the little toe ariseth from the third externall muscle of the foote although the lower backe-leader of the little toe or the seauenth Muscle will serue that turne.

The thirteenth.

The thirteenth Muscle ariseth with a broad and neruous originall from the ligament of the first ioynt of the little toe, sometime of the toe next it, afterward becomming fleshy, it passeth athwart ouer the first ioynt of the toes and determineth in a broad but short tendon which is inserted a little inward into the first ioynt of the great toe.

The vse of this muscle is double, first that when it worketh wee may better hold our feete as wee say, in vnequall places, for it maketh a kinde of apprehension. The second that when it worketh not, it might serue the foote in stead of a Ligament, least when we walke vpon the euen ground, the soale of the foote should be enlarged beyond that that is fit, and so the toes led one from another. Concerning this Muscle saith *Bauhine*, *Iulius Casserius* first writ vnto me.

Casserius.

The ten muscles betwixt the bones.

Vnder this muscle lye the tenne muscles called *Interossei* or the *bone-bound* muscles (for you must giue vs leaue to make english words as our Authors haue done in Greeke and latine) [tab. 36. 18. 19. z] which are to be referred to the benders of the toes. These haue their situation in the soale of the foote where they make a rude and indigested lump of flesh diuersified with right fibres, which lump proceedeth from the beginning of the after-wrist, and passing throughout his length fls vp the spaces betweene the bones and are inserted two and two into the rootes of all fise toes, or at the Ligament of the first ioynt toward the inside, that so when two worke together, they may bend the first ioynt, but when one alone worketh it leadeth the same ioynt to the side eyther outward or inward as the site and originall of the muscles is. To the short and broad tendons of these muscles doe grow for their further strength seed-bones, such as are in the hands, but greater.

The conclusion of the muscles.

And thus haue wee brought to an end this crooked and crabbed history of the muscles concerning which I know not whether I should rather craue pardon or pittie; pardon I presume I shall not neede to craue of them that vnderstand through what a labyrinth I haue led my pen: pittie also will do me little good now the paine is past. Acceptance shall be better welcome then eyther, and an ingenuous mind that measureth my foote by his own Last. One other passage remaineth in this Booke, and that is concerning those other kinde of flesh which are found in the body of man, to wit, the flesh of the *viscera* or *Entrals* and that of the *Glandules*, which two when we haue lightly passed ouer, we will proceede vnto the Booke of the Vessels.

CHAP. XLI.

Of the flesh of the Entrals or Bowels.



Parenchyma
what it is.

Alen esteemed the flesh of the Bowels to be similar and simple, not onely in respect of the mition, because all euen their least particles are of one and the like nature, whence some Arabians haue called it *Consusa*. *Erasistratus* called it first of all men *μαρμαρυγμα*, as it were an affusion or concretion of blood. This flesh *Erasistratus* esteemed to haue no other vse but onely to separate the vessels and to serue as

a soft cushion or pillow for them to rest on, and to strengthen and establish their passage, but we esteeme it to be of a great deale more excellent vse, for we thinke that it is the chiefe part of the bowell to which the officiall or common action thereof primarily appertaineth. So Sanguification primarily and of it selfe belongeth to the Flesh of the Liuer; to the veines secundarily onely and by influence.

His excellencie.

The Flesh of the Longues prepareth the ayre for the Heart, the Flesh of the Spleene purgeth the Lees or foeculencie of the blood, the flesh of the kidneies draweth & separateth the whey or vrine. Wherefore this Flesh maketh the proper substance of the bowell or entrall. Onely this amongst all sorts of Flesh is insensible, and according to *Galen's* testimony in *Arte parua* is of the number of those parts which haue their faculties seated and established in them not influent or deriued from other parts.

The Flesh of the Liuer is red and moderately thicke, neither doeth the heate thereof alone further the sanguification of the veines, as the Kell, the Spleene and the parts thereabouts doe assist the concoction of the stomacke: But by an in-bred and proper power it sealeth or imprinteth vpon the blood his stampe or forme, his temper and colour.

Of the Liuer.

The Flesh of the Spleene is a rare spongy or fungous *Parenchyma*, loose like the faster sort of sponges, and fit to draw and receiue muddie and melancholique humors.

Of the spleen.

The Flesh of the Kidnies is red, fast and solid, differing not much from the substance of the Heart, sauing that it is not intertexted or wouen with fibres. It was made solid, least if it had beene loose and flaccid it should not haue beene able to containe the vrine that it receiued. It draweth by an inbred power whey or vrine from the whole body, separateth it being mingled with the blood, and transfuseth it drop by drop into the membranous cauities.

Of the Kidnies.

The Flesh of the Longues is light, rare and like vnto a sponge, made as it were of the froth of the blood congealed together. It is light that it might easily be lifted vp, and fall againe without violence, and so readily obey or follow the motions of the Chest. It is rare and spongy that like a paire of bellows it might presently bee filled with the ayre wee breathe in, as also to make the way fit for the breathing out of sooty and smoaky vapours. This Flesh prepareth for the Heart one of the materials of the vitall spirit, that is ayre, for the outward ayre which hath much impurity mixed therewith, could not at the first hand be made a fit nourishment of the inward spirit, and therefore it was necessary that it should be altered by little and little, and by some stay made in the Lungs, acquire or attaine a quality familiar to the inbred spirit.

Of the Lungs.

Concerning the flesh of the Heart, it may be doubted whether it ought to be referred to the flesh of the bowels or to the flesh of the Muscles: *Galen* holdeth on neither side; for a *Parenchyma* hath no fibres, the Heart is wouen with them after a strange and admirable manner. Againe, the motions of the Muscles are Voluntary, so is not the motion of the Heart. The Flesh therefore of the Heart is peculiar to it selfe alone, such as you cannot finde in the whole body againe.

Of the heart.

There is no lesse scruple also concerning the Flesh of the Tongue, for it is as nimble as an Eele; turning it selfe into a thousand motions, yet are there no fibres running there-through, and therefore the flesh thereof cannot bee sayde to bee musculous, rather (if all things be considered) it inclineth to the nature of a *Parenchyma*. And so much shall bee sufficient to haue said concerning the Flesh of the Bowels or Entrals.

CHAP. XLII.

What a Glandule is, and how many kinds there be of them.

BEcause many of the Ancients haue defined a Glandule to be a *Flesh rowled vp into it selfe*: I haue thought fit sayth *Laurentius* for order sake to refer the whole kind or kin of Glandules vnto Flesh.

A Glandule therefore which the Græcians call *αδνη*, is a simple part, rare and fryable, soft like a sponge, appoynted by Nature to firme and establish the vesselles, to sucke or drink vp superfluous humors, & to water or dew some parts that stood need of moisture.

What a glandule is.

The Authour of the Booke *de Glandulis*, whether it were *Hippocrates* or *Polybius*, hath elegantly exprest the nature of a Glandule, where hee sayeth, *Their Nature is spongy for they are rare and fat*. That they are of such a nature you shall easily finde if you presse them hard

hard betwixt your Fingers, for they will yeeld an oylie humour and blood, white like phlegme. Now it is consonant to reason that they haue such a substance, not for nought, but for some particular and especiall vse. That vse is three-fold.

The first vse
of glandules,

The first vse of Glandules is to firme or establish the diuarcations or diuisions of the vessels. For it was to be feared least the vessels running through large and ample cavities, if they had no other muniment or defence sauing their owne membranes, would in violent motions be broken off, as in great windes boughes are torne from a tree; vnlesse these glandulous bodies did lye soft vnder them and establish & sustaine them. And therefore where the vessels are forcked or deuided, there Nature hath euer placed Glandules vnder them.

So in the diuision of the Gate-veine there is a notable Glandule called *Pancreas* or the Sweete-bread. In the diuarcations of the veines of the Mesentery there are Glandules almost infinite. In the distribution of the ascending trunk of the hollow veine is the Glandule called *Thymus*, which is the sweetebread in calues. In the vessels of the braine the Glandule called *Conarium* or the pine-glandule. In the necke, in the arme pits and in the groynes where the *Iugular axillary* and *crurall* veines are divided, there are Glandules placed to support their diuisions. Wherefore they were made soft and rare, that neither their hardnesse might offend the vessels, and by yeelding they might giue way to their distentions when they strut with blood.

The second
vse,

The second vse of the Glandules is like sponges to sucke and drinke vp fleame, whey and other superuacuous humours, that they should not rush vpon the more noble parts. In which respect their forme is round, somewhat long, and their substance rare and open; so fitted to receiue the greater quantity of any kinde of influxion. This vse the Author of the booke *de glandulis* openeth vnto vs in these words. They beare away the redundancie or surplussage of the rest of the body, and that indeede is their familiar Aliment. It may also by reason be demonstrated that they were ordained by nature to purge away moyst superfluities; for those parts that are hollow, and especially if they be moyst and full of blood, haue more and larger Glandules than those that are solide and lesse succulent, as are the ioynts. So behind the eares about the necke where the iugular veines run, about the arme-pit where the axillary branch is, and about the groynes where the crurall veine appeareth, there are notable Glandules which receiue the superfluities of the principall parts, the Brayne, the Heart and the Liuer, which Glandules are commonly called *Emunctories*, and if they swell or be otherwise affected, they betoken the distemper of their owne bowell or some ill disposition therein. *Hippocrates* in the second section of his 6. booke *Epidemion*, saith *Abcesses* or *Apossemes* (as for example the tumors of the Glandules) are produced as fruitlesse water-shoores of those places, out of which they grow. They also bewray the condition of other places and parts, and especially of the bowels. *Galen* also in the thirteenth booke of his *Methode* saith, that when an Apostematation ariseth neere any notable artery or veine, suddainly do spring vp *Bubones*, that is, inflammations of the Glandules.

The third vse.

Thirdly we adde in the definition, that the vse of the Glandules was to irrigate or water some parts lest they should too easily bee exiccated and dried or made vnfit for motion. Such are some of the Glandules of the Mesentery, which with their moysture doe dew the guts. Such are also the Glandules of the Throttle or the Tongue, which ingender or gather spittle. The Glandules in the corners of the Eyes do make much toward their celerity and ease their motions, and finally those prostrate glandules in the necke of the bladder doe water and moisten the Vreter with an oylie humidity, lest it should be offended by the Acrimony of the vrine. And this is the nature of Glandules properly so called:

Glandulous
bodies,

There is also another kinde of Glandules which may more truly bee called *Glandulous bodies*. Their substance indeede is like vnto a glandule, that is, rare and lax, but it is ordained by Nature for the generation of humours or iuyces which are profitable for the creature. Proper or simple glandules haue neither peculiar veines, nor arteries, nor nerues. And according to *Galen*, they are in the list of those parts which haue faculties inbred and seated in them, not flowing from elsewhere: but these glandulous bodies haue manifest and conspicuous vessels, and are also of exquisite sense. The former haue onely an vse in the body: these latter haue not onely an vse, but do also performe an action. So in *Galen* the Testicles are called glandulous bodies: for their substance is soft and hollow, in which the seede is boyled and perfected. So the dugs are glandulous bodies and haue a power or faculty in them for the generation of milke. Notwithstanding these glandulous bodies doe sometimes afford the same vse that the other glandules doe, that is, to sucke or sup vp the re-

crements

crements or excrements of the whole body: for Nature doth often abuse one and the same part to diuers vses. So *Hippocrates* reckoneth the Kidneyes in the number of the glandules, yea and the braine it selfe is like vnto a Glandule, for it is white and friable, and performeth the offices of a Glandule to the head.

CHAP. XLIII.

A brieue enumeration of the Glandules in the whole body.



HE number of the Glandules is almost infinite, we willl onely runne over the most notable, and of them giue you but a light view, because you haue heard their particular descriptions in their proper places.

In the braine there are 2 Glandules, not very great indeede but very notable.

The glandules
in the braine.

The first is of a turbinated figure commonly compared to a pine-kernell, and called *Conarium*; of which you shall reade in the twelfth chapter of our seuenth booke. It is thought to be ordained for an establishment vnto the veines and arteries which are disperfed into the braine, and maketh the way open for the Animall spirit out of the third into the fourth ventricle. The other is called *Glands Pituitaria*, the phlegmaticke Glandule; of which you shall reade in the thirteenth chapter of our seuenth booke. His porous or open flesh like a sponge receiue the superfluities of the vpper ventricles of the braine, and distilleth them into the Pallate through the holes of the wedgebone. Vnder the eares and behinde them there are many glandules called *Parotides*, appointed to establish the diuisions of the vessels, and to drinke vp the humors of the braine, whose Emunctories they are commonly stiled. Betwixt the skinn and the fleshy membrane of the Face there are many Glandules, saith *Platerus*, which they call *Animelles*, as also betwixt the lower side of the puffed of the cheek, and the beginning of the necke, where the Kings euill doth often arise.

Parotides.

In the inside of the chops which from the narrowness is called *Isthmus*, there do appeare two glandules like blanched Almonds, and therefore they are called the Almonds of the throate and Tonsillæ, and these doe perpetually moysten the chops, the mouth, and the tongue with spittle. There are also two at the roote of the Larynx or throtle, and two vnder the gullet, which oftentimes doe so swell that they interclude the way both of meate and drinke: but of drinke especially, for the solid meate makes it selfe a way by compression, whereas that which is liquid doth rather fill the fungous substance of the Glandule.

The glandules
of the Larynx.

Vnder the top of the breast-bone, in the very diuision of the ascending truncke of the hollow veine there is a glandule called *Thymus* a lecker or sweete-bit for nice pallats, made to establish the vessels.

Thymus.

There are also many others in the cavity of the chest, in the arme-pits, in the groynes, in the armes and in the legs. All which want proper names.

Vnder the Stomacke and the Gut called *Duodenum*, there is a glandulous body, which because it resembleth a simple flesh, they call *Pancreas*, whose vse is to sustaine, imbrace and comprehend the branches of the Gate-veine, which are to be distributed into the stomacke, the gut *Duodenum* and the Spleene, which are onele supported by the lower membrane of the Kell.

Pancreas.

In the Mesentery there are many Glandules, as well to distinguish the vessels as to keepe them from compression, when the guts are ouer-filled or when the *Abdomen* is too much strained, for otherwise the transcolation of the chylus would be hindered. These Glandules also do moysten the guts, and tye as it were the vessels together that in violent motions they might not be broken. In the necke of the bladder neare the sphincter muscle are those glandules which are called *Prostata*, of whose vse we haue spoken partly in the fourth booke, and partly in the former chapter.

The Glandulous bodies we need not in this place so much as to rehearse, for their descriptions are large enough in their proper places; whereto we referre the Reader, and here put an end to our booke of Flesh: and proceede vnto the vessels.

The end of the tenth booke.

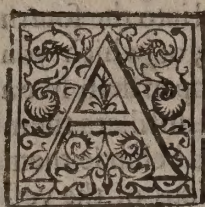
THE ELEVENTH BOOK, Of the Vessels, vvhich hath three parts:

The first of the Veines.

The second of the Arteries.

The third of the Sinewes.

The Præface.



In the Heavens the Angels are the Messengers of God, carrying downe his commandements vnto men whome also they guard and defend; so in this *Microcosme* the dull Flesh being of too slow a kind to ensue the noble motions of the Soule, which with his counterpoise it ofmer doth oppresse, our wise Creator ordained spirites of a middle Nature betweene the Soule and the Body, which like quicke Postes, like Pursuants or Heralds might trauell betweene them, and communicate their commission to the particular partes which they receiue eyther at the first hand from the Soule it selfe in the Brayne, or haue it sealed in the Heart or the Liuer, as in her subordinate Officers.

These Spirites *Hippocrates* calleth *Impetuous* bodies, because their motion is sudden and momentanie like the lightning, which in the twinkling of an eye shooteth through the whole cope of Heauen; yea so much more subtile are they then the Lightning, as that the one is visible the other inuisible: or they are like the winde which whiskes about in euery corner and turnes the heauy saile of a Wind-mill, yet can wee not see that which transports it. How necessary therefore was it that such subtile and vndertaking or active Creatures should be confined as well to guide their motion which otherwise would bee inordinate, as also to keepe them from exhaling or vanishing away. Nature therefore because the Spirites are of three sorts, Naturall, Vitall and Animall, hath prepared three kindes of Vesselles for their transportation, Veines, Arteries and Sinewes. The Veines because their guest is not so subtile but a more cloudy and thicke spirit, generated immediately out of the purer substance of the blood, haue but a single coate, as being sufficient to containe a more quiet spirit. The Arteries because their spirits are more sprightfull and impetuous, moouing alwayes with a subsultation, and perpetually playing vp & down, are made (as some thinke) sixefould as thicke as the Veines, the safer to immure the vnruely Inmate. The Nerues are nothing else but productions of the marrowy and slimy substance of the Brayne, through which the Animall spirits do rather Beame then are transported, inuested with the two Membranes wherein the Braine it selfe is inuested, commonly called the *Pia* and *Dura mater*. And this substance was indeede more fit for Irradiation then a conspicuous or open cavity, which would haue made our motions and Sensations more sudden, commotiue, violent and disturbed, whereas now the members receiuing a gentle and successiue illumination are better commaunded by our Will and moderated by our Reason.

The Natures of these three kindes of Spirites wee haue partly handled before in the third, the sixt and the seauenth Bookes: and therefore wee will no longer detain the Reader by way of Introduction, but descend vnto the particular Histories of their Vesselles.

CHAP.

CHAP. I.

What a Veine is.

Having wrought our way through the darke and shady groue of the Muscles *Nulli penetrabilis astro*, into the secret whereof I thinke no wit of man is able to reach: (And therefore it shall be no wonder if we bring some scratches out of so thorny a copse) we are now arrived in these medowes, where the vessels like so many brookes do water and refresh this pleasant Paradise or modell of heaven and earth; I meane the body of man. And surely by these streames doe grow many pleasant flowers of learning to entertaine and delight our mindes beside the maine profit arising there-from vnto the perfection of that Art we have in hand.

Vnder the name of vessels we vnderstand three kinds, Veines, Arteries and Sinewes, because out of these as out of riuers, doe flow into all the parts of the body Blood, Heate, Spirits, Life, Motion and Sense. Three kinds of vessels.

Wherefore *Hippocrates* is his Booke *de Corde* called them; *ποταμοὶ φύσας ἀνθρώπων*, the riuers of the body of man. Neither let any man taxe vs for inuerting our order when wee first begin with the history of the Veines, then descend vnto the Arteries, and lastly vnto the Nerues; because the Veines, are most simple as hauing but one proper coate and that thin; the Arteries, two and those thicker; but the substance of Nerues is manifold, as being within soft and marrowy, without membranous. For they must remember that the maine guide of our labour is the order of dissection. Now the originall of the Veines is in the lower region, at which we began our discourse. The originall of the Arteries in the middle region, and that of the Nerues in the vpper.

A veine therefore is by the latter Greeke writers absolutely called *φλέψ*, *Eudoxus* calleth it *ἐπανθισμός*, *Hesychius* *δρεζαμνν*, because it is the canale of the blood. The Ancient Physitions, as *Hippocrates*, vsed *φλέψ* as a common name to the veines and Arteries, so in his Booke *de carnibus*, There are two *κρῶλαι φλέβες*, saith he, two hollow veines issuing from the heart: the one is called a veine, the other an Arterie. Sometimes *Hippocrates* distinguisheth betwixt these two veines by adding the word *σφίγγειν*, which signifieth to beate, as if he should say Arteries are beating veines, veines those that doe not beate. Many places might be alledged to prooue this distinction if wee thought it needfull: *Auicenna* calls the Arteries beating and bold veines; *Cicero* *venas micantes* which doe sometimes lift vp themselves, and sometimes sinke againe. *Celsus* calleth them veines fitted for the spirits, and the true veines he calls *quietas*, still veines. *Hippocrates* is his Booke *de morbo sacro*, to distinguish the veines from the Arteries which are the conceptacles of the spirits calleth them *ἀραιαί φλέβες* bloody, because they conuey the blood. The names of veines.

The latter Grecians haue included this name within narrower bounds and restrained it onely to quiet or still veines which haue but one simple coate, in whose foote-steps wee also doe insist calling the arteries not *φλέβες*, but *ἀρτηρίαι*, so the vessels being distinct their names also are distinct.

Furthermore, the vessels are distinguished in their structure motion and vse. In the structure, because a veine hath a thin coate, whereas the coate of the Arterie is very thicke. In their motion, because an Arterie is mooued perpetually and conspicuously with a dilatation and systole, that is, a dilatation and contraction, whereas the veine is altogether immooueable. In vse because the Arterie transporteth the vitall spirit together with exceeding thin blood. The veines carry a thicker blood and a more cloudy spirit: the veins haue an inbred faculty to alter and boyle the blood: the arteries haue no such faculty, because their blood attaineth his vtmost elaboration and perfection in the heart. But let vs come to the definition of a veine. How veines & arteries differ.

A veine may be considered two manner of wayes, either as it is a Similar, or as it is an organically part. *Galen* in his 2. Booke *de Elementis* accounts it Similar, if not in deede, yet at least according to the iudgement of the sense; againe, in his Booke *de morborum differentiis*, hee proueth that it is organically, for he calleth Veines Arteries and Muscles organs of the first kinde and most simple organs. Two considerations of a veine.

If you regard a veine as it is a Similar part, then must you define it by his temper, (for the temper is the forme of the similarity, that I may so speake) to bee *A cold and drie part generated out of a slimy and following portion of the seede*. I sayde it was cold in respect of his As Similar.

his naturall temper, for otherwise by the contaction of the blood and the perfusion of the spirits it is very hot. And in *Galens* first Booke *de temperamentis*, it is sayd to be hotter then the skin.

As organically.

If you consider a veine as it is an organically part, then shall you define it to bee *A vessell long, round, excavated or hollowed like a reede, having but one end and that a thin coat, wouen with all kinds of fibres, arising from the liver, and appointed or set apart by Nature to containe, boyle and distribute the blood.* In this definition you haue the figure, composition, originall, use and action of the organ elegantly described. The roundnesse and cauity of the vessell expresseth the figure of the organ whereby a veine is distinguished from a nerue, for nerues haue onely pores but no sensible cauities. *Praxagoras* therefore was in an error and so are those that follow him, who call nerues *venas continuatas* continued veines.

The explication of the definition.

The simple and thin coate noteth the structure of the vessell, and discriminateth or putteth a difference betwixt a veine and an artery, for an artery hath a double coate, one outward and another inward, and if wee may beleue *Erophilus* it is five-fold thicker then a veine, because it containeth thinner and more spryghtfull blood, which if it were not concluded or shut vp within thicke wals would easily breake prison and vanish away.

This simple coate hath fibres of all kinds, right, oblique and transuerse, if not for his owne priuate nourishment, to which the attracting, retayning, and expelling faculties are seruicable; yet for a common vse to retayne and draw the blood (which is the treasure of Nature) from the neighbour veynes, to transmit the same from one to another and so to make distribution: finally to separate the pure from that which is impure. I thinke also sayth *Laurentius* that the fibres were ordayned *ad συνπαθήειαν*, that is to auoyde an inconuenience. For because oftentimes the blood aboundeth in quantity and offereth a kinde of violence to the veynes, sometime by right, sometime by oblique, sometime by transuerse extensions; the veynes stood in neede of all kindes of fibres, that they might bee so extended according to all the violent occurrsions and impressions made by the blood, for otherwise they would certainly be broken. These fibres are the first, most simple and truely solyd particles of the veine, but the substance which filleth vpe or stuffeth out the spaces betwixt the fibres is called fleshy by Analogy or proportion.

The fibres of the veynes sayth *Galen* in his second booke *de temperamentis*, are colder then the skinge, but the flesh that commeth betwixt them is hotter. Hence it appeareth, that the coate of the veyne differs much from the nature of other membranes, as of the *Peritonaeum* or rimme of the belly, the *Pleura* which compasseth the ribs and the *Periosteum* which immediatly inuesteth the bones: for these are indeed simple having no separated fibres, and may be torne or divided every way as paper may. But the coate of the veynes is dissimilar because it hath both fibres and flesh.

The common
coate of the
veines.

This proper coate of the Veines is inuested oftentimes with another called a *Common coate* which it borroweth from the neighbour partes, from the *Pleura* the Veines of the Chest doe borrow, and from the *Rimme* those in the lower belly. I said they haue often a *Common coate*, for all veines haue it not; for example, those that are sprinkled thorough some bowell, those that wander through the bodies of Muscles, and finally those which are inserted into the parts and in them are propagated or encreased: for such a membrane would hinder the blood that it should not so readily sweat through. Those Veines onely haue this common coate, which either doe runne a long journey, or lye vpon some hard body, or at some place are suspended or hung to any particular part: & such is the structure of a Veine.

The common
use of the
veins.

The beginning of the Veines, the Definition sayeth is the Liuer, not a beginning of generation or *originall*, (for that is the common worde though the first I thinke bee better) for all the parts are formed together: But of *Radiation* and *Dispensation*. Of *Radiation*, because the roots of the gate and hollow veines are sprinkled through the whole *Parenchyma* or flesh of the Liuer according to that of *Hippocrates* in his Booke de *Alimento*, *ἐξ ὧν οὐλεβα ἡνταρ* the *Radiatio of the Veines is the Liuer*. Of *Dispensation*, that is, of distribution and office, because from it a common matter (to wit the blood which is the common Aliment of all the parts) is deriued into the Veines; wherefore by *Hippocrates* it is called *ἰναλὸν* the fountaine and originall of pleasant and benigne humour.

The last particle of the Definition designeth the common vse and action of the Veines, for they are set apart to leade or transport, to distribute or apportion and to boyle the blood. But why this is so and how it commeth to passe, I will now addresse my selfe to declare.

CHAP. II.

Of the Vse and Action of the Veines.

BEcause the threefold substance which is in euery particular part issuing from the originals or principles of our generation, doth continually waste and suffer detriment; Nature who is studious of her owne conseruation, by a perpetuall affluence of Aliment laboureth to restore and make good that which is so necessarily spent and depopulated. The common Aliment of the parts is the blood, which all the Veines do draw from the Liuer as out of a common *magazine* or store-house. Now the blood could not be transported from the Liuer to those parts which are most distant and remote from it, vnlesse those parts had some continuity with the fountaine.

It was therefore necessary that there should bee made and formed certaine canales (as it were water-pipes) bored, to containe, conserue and conduct the blood throughout the whole body. Such are the Veines which *Aristotle* calls the vessels or conceptacles of blood. The blood therefore is containd in the Veines as in his proper place, and as the Elements in their proper places receiue no alteration; (for *the place is the conseruer of the thing placed*) so the blood within the Veines retaineth his benigne nature, but out of the Veines it presently either putrifieth or caketh.

There is therefore in the Veines an inbred power to containe and preserue the blood, which also is their primary vse. Another vse that the Veines haue is to distribute the blood; which distribution is performed by an action, that is, by attraction or drawing from the neighbour Veines, and by transmission or transportation vnto others, and for this action sake were the right and circular fibres of the veines ordayned.

Hippocrates in his Booke *De Alimento* maketh mention of a third vse of the Veines, & that is to leade along heate and spirits into the particular parts. And thence it is that though the Arteries be tyed, the partes doe not presently *sphacelate* or mortifie, because by the Veines there is an influence of a double heate and spirit, that is to say, Vitall and Naturall. The Vitall they receiue from the Heart by the wonderfull Anastomoses or inoculations of the Arteries; the Naturall they draw directly from the Liuer. By this influent spirit the inbred *Genius* of euery part is roused vp and quickned, and by it as by a good Manciple is the nourishment conueyed into the whole body.

The last vse of the Veines (which must bee referred also to their common action) is the alteration of the blood, for they are qualified to coyne and change the blood, some to prepare it as the Mesentery, others to perfect it as the great branches of the hollow veine. And this faculty or qualification they haue from the Liuer by *Irradiation*, as the Seminary vessels haue from the Testicles that power which they call *σπερματικὴ δύναμις*.

There are also other particular vses of priuate Veines; as of the Emulgents to conuay the Serous or wheyie humor; of the seede vessels to giue a rudiment vnto seede: of the *Mesaraicks* to alter the *Chylus* and to transport it to the Liuer; of the venall or short vessel to belch out melancholy iuyce into the cavity of the stomacke for the prouoking of appetite; of the veynes of the wombe to exclude the surpluse of blood at certaine and determinate periods; of the veines of the spleene to purge *seculent* or drossy blood, and so of the rest: for particulars we shall better handle in the following discourse.

Hippocrates the Oracle of Physicke, from the habit and structure of the veynes, drewe many and those notable signes of the state of the whole body. Those that haue broade Veines, sayth hee, haue also broade bellies and broade bones, for, because the blood through the veines is diuided into the whole body, wee may well make estimation of the plenty and temper of the bloode by the amplitude or straytnesse of the Veynes. They that haue much blood are esteemed hot, for their veynes are large. If the veynes bee narrow and slender, *Aristotle* accounteth them cold. They that haue much flesh haue small veynes, red blood, and little bellies and bowels: on the contrary, they that haue little flesh haue large Veynes, blacke blood, greate bowels, and side wombes or bellies. Finally by the veynes the whole body hath a kind of connexion or coherence, whence it is that they are called common ligaments.

Eccc

CHAP.

The necessity
of the veines.

Their first vse.

The second.

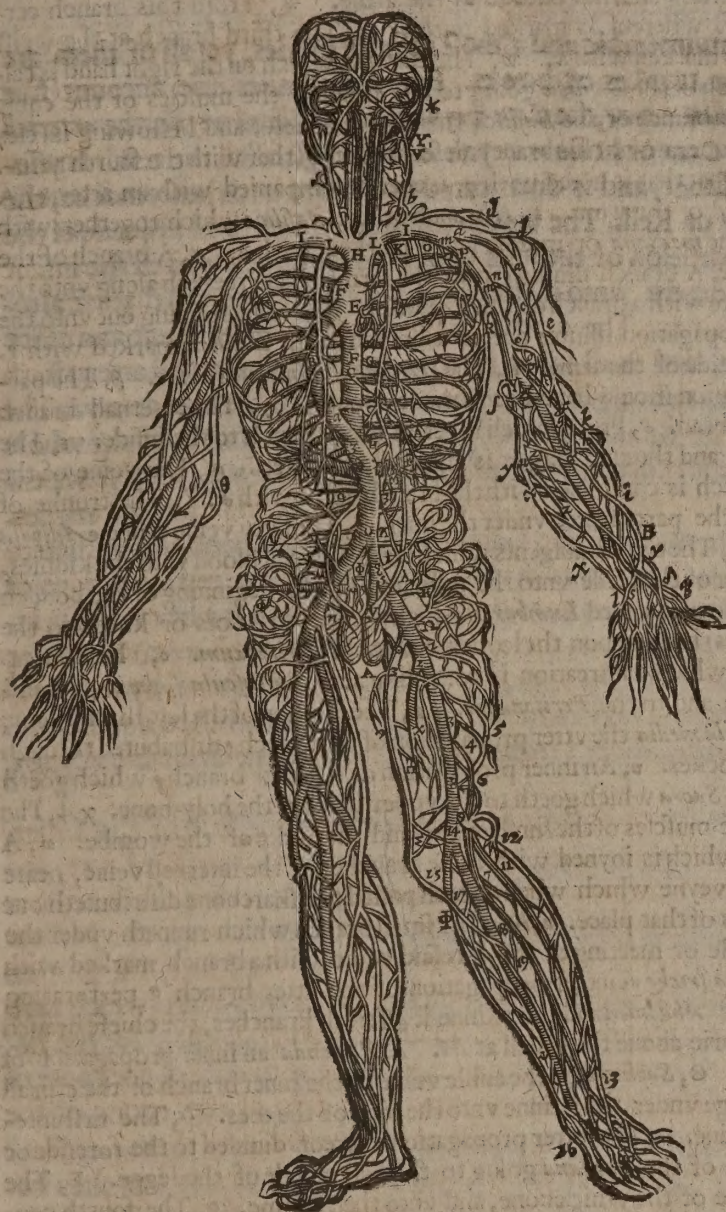
The third.

The fourth.

Peculiar vses
of priuate
veines.

Table 1. Sheweth the hollow veine, whole and freed from the whole Body.

TABVLA I.



A, The trunk of the hollow veine, the lower *AA*, At this place of the Liver, is seated the left part of the veine, and distributeth branches to the left side.

B, Sheweth how the trunk of the hollow veine in the chest (to giue way to the heart) is curved or bowed to the right hand.

Betwixt A, and B, that part of the hollow veine which is betwixt the Gibbous side of the Liver and the Midriff.

C, the left midriff veine called *Phrenica sinistra*, from which furcles doe runne in a man vnto the purse of the heart, for the midriff and it doe grow together.

D, the orifice of the hollow veine which groweth vnto the heart.

E, the crown veine called *coronaria*, which like a crowne compasseth the basis of the heart, and sprinkleth his furcles on the outside thereof as farre as to the cone or point.

FF, the trunk of the veine, *Azygos* or *non parill*, descending along the right side of the racke-bones vnto the loynes.

GG, the lower intercostall veines, to the branches of the veine *Azygos*, which goe vnto the distances betwixt the ribs, & afford furcles vnto the muscles which lye vpon the ribs and the racke-bones, and the membranes of the chest.

H, the diuision of the hollow veine into 2 subclavian trunks neare the Iugulum vnder the brest-bone.

II, the subclavian branch tending on eyther side vnto the arme, called by some *Axillaris*.

K, the vpper intercostall veine which

commonly sendeth three slips vnto the distances of the vpper ribs, vnto which the first intercostall veine sent no branches. *LL*, the descending mammary veine: this descendeth vnder the brest-bone vnto the right muscles of the *Abdomen*, and affordeth furcles to the distances of the griffles of the true ribs, to the Mediastinum, the muscles that lye vpon the breast and the skinne of the *Abdomen*. *M*, the coniunction of the mammary with the Epigastricke veine ascending about the Nauill vnder the right muscles. *N*, the veine of the necke called *Cervicalis*, ascending toward the Scull which alloweth furcles to those muscles that lye vpon the necke. *O*, the veine called *Muscula*, which is propagated with many furcles into the muscles that occupy the lower parts of the necke and the vpper parts of the chest. *P*, *Thoracica superior*, the vpper chest veine which goeth to the muscles lying vpon the chest, to the skinne of that place and to the dugges. *Q*, the double *Scapularis* distributed into the hollow part of the shoulderblade and the neighbour muscles; so also betwixt *P* and *R*, sometimes small veines do reach vnto the glandules that are in the arme-holes. *R*, *Thoracica inferior* running downward along the sides of the chest, and especially distributed into the muscle of the arme called *Latissimus*. *S*, the inner Iugular veine which entreth into the Scull after it hath bestowed some furcles vpon the rough artery. *T*, the externall Iugular veine. *V*, The diuision of this veine vnder the roote of the eare. *X*, A branch of the externall Iugular which goeth into the inside of the mouth, and is diuersly diuided into the parts therein contained. *Y*, the exterior branch distributed neare the *Fances* into the muscles of the chops and the whole skinne of the head. *Z*, A portion of the branch, reaching vnto the Face. *aa*, the veine of the fore-head, a portion of it creeping through the temples *a*, * A propagation that goeth vnto the skinne of the Nowle or *Occiput*. *aa* The veine called *Cephalica*, or the externall veine of the arme which others call *Humeraria*. *b* *Muscula superior*, A propagation of the *Cephalica* veine which goeth vnto the backward muscles of the necke. Betwixt *b* and *d* on the backside islueth a branch from the *Cephalica* which passeth vnto the outside of the blade, and a portion thereof runneth betwixt the flesh and the skin. *d* *d*, A veine from the *Cephalica* which attaineth vnto the top of the shoulder, and is consumed into the muscle that eleuateth or lifteth vp the arme

and into his skinne. *cc* A small veine from the *Cephalica* dispersed through the skinne and the muscles of the arme. *f*, The diuision of the *Cephalica* into three parts. *g*, The first branch runneth deepe vnto the muscles which arise out of the externall Protuberation of the arme. *h*, The second branch which goeth to make the *median* veine. *ii*, The third branch running obliquely aboue the wand and the outside of the arme. *k*, From this branch certayne furdles are diuided into the skinne, the chiefe whereof is marked with *k*. *l*, The third branch at the wrist which is ioyned at *l*, with the branch of the *Basilica* marked with *x*. *m*, The *Basilica* which on the right hand is called *Hepatica*, on the left hand *Lienaris*. *no*, A branch of the *Basilica* going to the heads of the muscles of the cubit at *n*, and to the muscles themselves at *o*. *p*, A notable branch of the *Basilica* running obliquely, and bestowing furdles vpon the muscles that yssue from the externall protuberation. This branch descendeth together with the fourth nerue. *q*, Thdiuision of the *Basilica* into two branches, and that that is noted with *q*, is euer accompanied with an arterie. *r*, A branch of this veine bestowed vpon the the skinne of the arme. *s*, A branch of the *Basilica* which together with the branch of the *Cephalica* marked with *h*, makes the *mediana* or middle veine marked with *a*. *u*, A branch of the *Basilica* going to the inner head of the arme. *xx*, A branch issuing out of the former that creepeth along vnto the skinne at the outside of the cubit. *yy*, A propagation issuing out of a branch of the *Basilica* marked with *r*. *z*, A branch of the *Basilica* *xx*, going to the inside of the arme. *a*, The *Median* or common veine. *b*, The partition of the median veine aboue the wrist, this diuision should haue bene made aboue *y*. *y*, The externall branch of the partition which goeth to the outside of the head. *z*, From which issueth a small branch to the inside. *e*, The internall branch vnder *e*, which toward the middle and the ring finger is especially disposed. *g*, The veine of the thumbe dispersed into his mountenet or hillock which is conioyned with the branch noted with *z*. *z*, The trunk of the hollow veine from which issue branches vnto the parts seated vnder the liuer. *n*, The fatty veine called *Adiposa sinistra* which goeth vnto the fat of the kidnies. *th*, The two Emulgents which leade wheyey blood vnto the kidnies. *mu*, The two spermatieall veines leading the matter of the feede vnto the testicles. *V*, The beginning of the bodden vessell called *vas varicosum*. *z*, The veines of the loynes called *Lumbares* which are sent in knots or knees to the rackebones, to the marrow of the backe, to muscles that lie vpon the loynes, and to the *Peritoneum*. *o*, The bifurcation of the hollow veine into the black branches, which bifurcation is not vnlike *Δ*. *π*, *Muscula superior*, a transuerse branch going to the muscles of the *Abdomen* and to the *Peritoneum*. *ρ*, The diuision of the left blacke veine into an inner branch at *ρ*, and an vtter at *σ*. *τ*, *Muscula media* the vtter propagation of the branch *ρ* distributed through the muscles of the *coxa* and the skinne of the buttockes. *υ*, An inner propagation of the same branch *ρ* which goeth vnto the holes of the holy bone. *φ*, The veine called *Sacra* which goeth to the vpper holes of the holy-bone. *χ*, The veine *Hypogastrica* distributed to the bladder, to the muscles of the fundament, and the necke of the wombe. *ω*, A veine arising from the vtter branch marked with *σ* which is ioyned with some branches of the internall veine, neare the holes or perforations of the sharebone. *ε*, A veyne which when it hath passed the sharebone distributeth one branch into the cup of the *coxendix* and to the muscles of that place. *κ*, Another small branch which runneth vnder the skinne at the inside of the thigh. *ζ*, The congresse or meeting of the foresaid veine with a branch marked with *char. 2*, and distributed into the legge. *ι*, The *Epigastricke* veine, a propagation of the vtter branch *σ* perforating the *Peritoneum*, whereto as also to the muscles of the *Abdomen* and the skinne it offereth branches, the chiefe branch of this veine is ioyned with the descending mammarie aboue the nauell at *M*. *Δ*, *Pudenda* an inner propagation of the branch *σ*, running ouerthwart vnto the priuities. *Θ*, *Saphena* or the ankle veine or the inner branch of the crurall trunk, which creepeth through the inside of the legge vnder the skinne vnto the tops of the toes. *Α*, The first interior propagation of the *Saphena* offered to the groine. *Ξ*, The vtter propagation thereof diuided to the foreside or outside of the thigh. *Π*, The second propagation of the *Saphena* going to the first muscle of the legge. *Σ*, The third propagation of the *Saphena* going to the skinne of the whirlebone, and vnto the Hamme. *Φ*, The fourth propagation of the *Saphena* dispersing his muscles forward and backward. *Ψ*, Branches from this vnto the foreside of the inner ankle, to the vpper part of the foote, and to all the toes. *Ω*, *Ischias minor* called also *muscula interior*, the vtter branch of the crurall trunk diuided into the muscles of the *coxendix*, and to the skinne of that place. *1, 2*, And this also may be called *muscula*, the exterior and lesser which passeth into some muscles of the legge: *2*, the interior greater and deeper vnto the muscles of the thigh. *3, 4*, The veine called *Poplitea*, made of two crurall veines diuided vnder the knee. *5*, From this a furdle is reached vward vnto the skinne of the thigh. *6*, But the greater part runs by the bent of the knee vnder the skinne as farre as to the heele. *7*, Also to the skinne of the outward ankle. *8*, The veine called *Suralis* or calfe veine, because it runneth vnto the muscles that make the calfe of the legge. *9*, The diuision of the *Suralis* veine into an exterior trunk *9*, and an interior *14, 10, 11*, The diuision of the exterior trunk vnder the knee into an externall branch, which along the brace attayneth vnto the muscles of the Foote *11*, and in internall. *12, 13, 12, 13*, Which descending along the outside of the legge to the vpper part of the Foote is clouen into diuers branches, and in the backe of the Foote mixeth it selfe with *Poplitea*, or the hamme veine *20*. *14*, The interior branch of the *Suralis* veine which runneth into the backside of the legge. *15*, A branch hereof descending to the inside of the heele and the great toe & is diuided into diuers furdles. *17*, *Ischias maior* issuing out of the internal trunk at *14*, and running through the muscles of the calfe. *18*, A propagation hereof deriued vnto the vpper part of the foote, and affording two furdles to euery toe. *19*, The remainder of the inner trunk *14*, behinde the inner ankle, approacheth to the bottome of the Foote and is consumed into all the toes. *20*, the commixtion of the veine *Poplitea* with the *suralis* or Calfe-branch at *13*.

are

vena Azygos or the *nonparell*. Others haue companions, as almost all the rest. Others againe are solitary, that is, haue no artery accompanying them, as the veine of the arme which is called *Humeraria*, others haue arteries bearing them company.

This by the way wee must obserue, that the veines are more and greater then the arteries, because they containe a thicker Aliment and more cloudy spirit.

From the situation a veine is sayd to bee vpper and lower, ascendent, descendent; right left; externall, internall; so the splenicke branch is called *sinister* the left, the mesentericke *dexter* the right. So *Hippocrates* in his Booke *De victus ratione in acutis*, calleth the *Basilica venam internam*, the internall veine, because it runneth through the inside of the cubit, and the *Humeraria* he calleth *externam*, because it runneth on the outside.

In respect of their office or function, some veines are called *Emulgentes* the suckers because they sucke and separate wheyie humours; others *spermatice*, because they giue the seede a rudiment.

In respect of the parts through which they run, the veines haue diuers names, *Jugulares*, *Phrenica*, *Renales*, *Iliaca*, *Hypogastrica*, *Epigastrica*, *Axillares*, *Humeraria*, *Crunales*, *Poplitea*, *Asalleoli*, &c. because they run through the sticking place, the midriffe, the kidneyes, the hanches, the watercourse, the lower belly, the arme pits, the armes, the legs, the hammes and the ankles.

But because you might haue, as it were, in one view all the veines of the body, to know their deriuations, we haue to this chapter annexed a table which exhibiteth the course of the hollow veine from the crowne of the head to the soale of the foote, and the description adioyned thereto, which will poynt out euery particular. As for the skin veines how they appeare on the surface of the whole body, you haue also a generall view of them in the eight chapter of the second Booke, and therefore we will not repeate their Tables in this place, but descend vnto the particular history, beginning with the gate-veine.

CHAP. IIII.

The description of the Gate-veine and his branches.

 Gaue you (because the order of dissection so required) a briefe compend of the distribution of the Gate-veine in the third chapter of the thirde Booke, reseruing there the more exact discourse vnto this place, which therefore wee will now attend as carefully as we may.

That which they call the Gate-veine [table 2.] some thinke is a propagation from the vmbilicall veine, to which as we sayde it is continued. It issueth out of the hollow part of the liuer, which part or rather the very ingresse of the vessell (betwixt the 2. small Eminencies of the liuer) *Hippocrates* and *Galen* and the whole family of the *Asclepiads* doe call *πύλας* the Gate. It is the greatest of all the veines next the hollow veine, and therefore *Galen* in the twentyeth chapter of his fourth Booke *De Vsu Partium* calleth it *μεγίστη*, or the great veine, the hollow veine hee calleth *μεγίστη*, or the greatest veine, but this most commonly he calls *the veine which is at the Gate*, because by the roots hereof, that is to say, the Meseraicke branches, the *Chylus* is suckt away from the stomacke and the guts, and through the trunk hereof as through an open gate is let into the liuer. Whereupon the *Meseraicks* are called *manus hepatis*, the hand of the liuer. The Physicians call it commonly *vena porta*, the gate-veine, the Arabians *venam lacteam*, or the milky veine, because it draweth the *Chylus* which is like vnto milke, but of the *lactes* there is another speculation.

For order sake we will diuide this Gate-veine into rootes, branches and the trunk it self. The roots are small and abundant, desseminated [tab. 2. char. 1, 2, 3, 4, 5] through the substance of the liuer from whence as from a principle of distribution (saith *Galen* in the fourth chapter of his Boode *de formatione fetus*, and in the third of the seuenth *de placitis*) and of Radication (saith *Hippocrates* in his Booke *De Alimento*) they doe arise. These small roots by degrees grow into greater, and those yet into greater, till all of them about the middle of the liuer on his hollow side neare vnto the backe are vnited, and make one notable trunk [tab. 2. B] which issueth out of the liuer. These rootes whilest they remaine in the liuer, are ioynd by inoculation into the middle of the rootes of the hollow veine as we haue shew- ed in the thirteenth chapter of the third Booke and the fourteenth table.

Ecce 3

The names of
the gate-veine
and the reason
thereof.

The diuision
of the gate
veine.

In

In dogs there are so many bowes of the gate-veine as there be lobes of the liuer, euery one of which is diuided into his owne lobe, and yet all of them meete into one common trunk. Notwithstanding they may be called Rootes and branches. Roots, because this veine is sayde to be the sprout of the Liuer, and because they leade blood vnto other parts. They may also bee called branches because the meseraicks (which *Galen* likening it to a tree, calleth the Rootes) when they haue suckt the Chylus doe send it vnto the Trunke, from whence by these branches it is distributed into the Liuer.

Sometimes from the rootes of the Gate-veine from the very top of the left part of the Liuer neare his Ligament, yssueth a braunch which is communicated to the Midriffe, and descending on the backside is ioyned vnder the *Pancreas* or Sweete-bread with other branches which arise out of the trunk of the gate-veine. Sometime also a few branches arising out of the same place doe attaine vnto the Spleene and are disseminated into his substance.

The trunk.

The Trunke [tab. 2. B] descending from the Liuer runneth a little obliquely downward vnder the Gutte called *Duodenum*, hauing gotten a firme seate about the Rackebones.

Where deu-
ided & why.

It maketh his distribution betwixt the Stomacke and the Guts as in the fittest place, because it is the middest of the organs of nourishment where it was fit that distribution should be, that the veines might be equally diuided amongst them. For if it had descended lower it had departed too farre from the Stomacke. If it had ascended higher, first it would haue beene too farre from the Guts; and againe, could not haue had so easie access vnto the stomacke, which sometimes strutteth with abundance, and againe falleth when it is empty. From this Trunke therefore diuers propagations are distributed in the lower belly into the Stomack, the Guts, the Kell and the Spleene.

The trunk
Cystica Gemela

The Trunke [tab. 2. B] before it is diuided parteth with two small branches from his foreside. The first are called *Cystica Gemella* the Twinne-veines of the Gall [tab. 2. C C] which yssuing fromward the left side of the trunk are reflected vward and toward the right side vnto the necke of the bladder of Gall and the body thereof, through which they are distributed in hayrie branches as are the small vessels through the white of the Eye.

Gastrica dextra

The second is called *Gastrica dextra* [tab. 2. D] the right stomacke veine. It ariseth much lower then the twins and rather from the right side of the Trunke on which side it passeth onely vnto the backparte of the stomack and the *Pylorus* or lower mouth thereof, and affordeth them small branches.

Ramus splen-
icus.

Afterward the Trunke inclining to the left hand is deuided into two notable bowes [tab. 2. E] the vpper or the left, and the lower or the right. The vpper [tab. 2. F] although it be altogether spent into the Stomacke and the Kell; yet from the vse it is called *Splenicus* or the Spleene-branch, because it draweth to it selfe out of the *Chylus* altered in the *Meseraicke* veines the thicke part of the iuyce before it bee gotten to the Liuer, and leadeh it to the Spleene as we haue sayde before in the History of the Spleene, wherefore also it is placed about the trunk of the Meseraicks. [tab. 2. G] The lower bow is called *Mesentericus* the mesentericall branch [tab. 2. G] because almost all of it is diuided into the Mesenteric.

Mesentericus.

The Splenicke branch being supported with the Membrane of the Kell and a glandulous body, runneth ouerthwart to the Spleene, and before it bee consumed therinto, there proceede branches out of it, some before some after the deuision. Before the diuision some yssue from the vpper part some from the lower. From the vpper part two veines spring.

Gastrica minor

The first is called *Gastrica minor* the lesser Stomacke veine, and [table 2. K] the left is deuided into the gibbous and backpart of the Stomacke with a few branches.

Gastrica maior

The second is called *Gastrica maior* [tab. 2. N] the great Stomacke veine, because it is the largest of all the veines that come vnto the Stomacke. It runneth obliquely vnder the stomacke to his vpper orifice or mouth, and is diuided therinto, sending out of the trunk three boughes; of which, one on either side is conuayed to the Stomacke, [tab. 2. O O] the middle runneth vward and compasseth the vpper mouth of the Stomacke like a crowne, and maketh that veine which thereupon they call *Coronaria stomackicam* the Crowne veine of the Stomacke, [tab. 2. Q] which in dogges is very conspicuous. From this veine some small ones are offered vward vnto the end of the Gullet, some downward to the Stomacke.

Coronaria
Stomackicam.

Sometimes also another branch arising from the other propagation runneth downward,

ward, and on the foreside passeth the *Pylorus* or lower mouth of the Stomacke with many Surcles. From the lower part yssue three branches.

The first is called *Epiplous dextra* [tab. 2, L] the *right Kell veine*. It is but a slender vessell, and deriueth his Surcles downeward to the right side of the lower membrane of the Kell, and to the Collicke Gut which is thereto annexed. *Epiplous dextra*

The second is called *Epiplous postica* [tab. 2, S] the *hinder Kell veine*. It is larger then the former and is deuided into 2. branches which are very much separated, out of which surcles doe runne downeward to the lower membrane of the Kell, (wherewith the Collicke Gut is tyed to the backe as it were with a Mesentery) and to some part also of the *Colon* it selfe. In Dogs there is no veine from the spleenicke branch vnto the Collicke Gut. *Epiplous postica*

The third called *Pancrea* [tab. 2, M] are many small and capillary veines which runne betwixt the two Kell veines as wel aboue as below, and are disseminated into the Sweetbread which is called *Pancreas* from whence they haue their name. *Pancrea*

When these branches are produced, the Splenicke [tab. 2, F] Trunke is cleft into an vpper and a lower branch, [tab. 2, T] and these into others.

From the vpper braunch doe arise sometimes three, sometimes more, sometimes one from the top of the branch neare the Spleene which they call *Vas breue* [tab. 2, the vpper Z] or *Vas venosum*, the *Short* or the *Venall vessell*, which is in some men greater, in some men lesser, and these latter doe easily indure hunger, the former with great difficulty. And hence it is that some men if they bee neuer so little a while without meate, or betweene their refectiōs they fall into a *Syncope* or swooning; by this braunch also come oftentimes blacke vomits. *Vas breue*

[Table 2. is the same with Table 3. lib. 3.]

These Veines being sustayned with the vpper membrane of the Kell, are inserted into the left side of the bottome of the Stomacke, and sometime higher that they might belch that naturall melancholly which could not bee changed into the Aliment of the Spleene, into the bottome of the stomacke; sometimes into his mouth (which *Vesalius* witnesseth that he hath seene) to stirre vp the drowsie appetite with his tartnesse, before the mouth of the Stomacke be corrugated for too much want; for that sowre thinges doe prouoke appetite we are taught by the sharpe Sallets that are vsed in the beginning of our Suppers. Beside, the adstriction or binding property of this humour strengtheth the mouth and helpeth the concoction of the body of the stomacke. Sometimes also from another propagation of this branch, veines are transmitted to the Stomacke, and these tye the Stomacke and the Spleene fast together.

From the lower branch of the Splenicke bough proceede two veines. The first is called *Epiplous sinistra* or the *Left Kell veine* [tab. 2, F] which in one or two surcles is distributed into the left part of the lower membrane of the *Omentum* or Kell, especially when the hinder Kell veine is narrow, wherefore this veine is not alwayes found. *Epiplous sinistra*

The second is called *Gastro-epiplous sinistra* [tab. 2, X] the left Stomacke and Kell veine. It is a notable braunch, and reflected to the right hand compasseth on that side the bottome of the Stomacke where the small branches of this veine are intangled with the slender surcles of the right, and touch either the other extremities. It affordeth also small branches, but very plentifull to the left side of the vpper membrane of the *Omentum*. *Gastro-epiplous sinistra*

The remaynder of both braunches being diuersly wouen together, are implanted in great abundance [tab. 2, Y Z] into the hollow and middle line of the Spleene, and are distributed through his whole body to purge the feculent iuyce, and to leade it to the spleen, and thus much of the left or vpper branch of the gate-veine.

From the lower and Right branch [tab. 2, G] which is also the largest, before it bee diuided, two veines do yssue.

The first is called *Gastro-epiplous dextra* [tab. 2, H] the *right Stomacke and Kell veine*. It yssueth from the side of the branch before it bee deuided into the mesentericall branches. Sometime it ariseth out of the Trunke it selfe, sometimes also but very rarely out of the left branch, and on the right side watereth the bottome of the stomacke both before and behind with many small surcles which insinuate themselues euen into his cavity. It cree- *Gastro-epiplous dextra*
peth also through the vpper membrane of the Kell, and at the middle of the stomacke it ioyneth his small surcles with the left *stomacke and kell veine*. [tab. 2, X] In Dogges some-
time

time it yssueth from the Gut-veine. Sometime it is wanting and then the left supplyeth the place of both.

Intestinalis.

The second is called *Intestinalis*, [tab. 2, 2] or the gut-veyne. It issueth sometimes out of the branch, sometimes out of the trunke at the middle of the *Duodenum* or the beginning of the *Ieiunum*, and runneth directly downward through their length, it disperseth certain small branches as fine as hayres through the vpper *Omentum* and through the *Pancreas*.

Afterward the whole branch [tab. 2, 6] where it ioyneth with the mesentery, departeth into three mesentericall branches, two on the right hand and two on the left.

*The mesentericall
veynes.*

The right mesentericall branch is double, [tab. 2, 6] and is implanted into the *Ieiunum*, the *Ileon*, the *Cacum*, and the right part of the Colon on the backe or hollow side, and being diuided into innumerable furcles, as the rootes of a Tree are diuided into slender strings (whereto also *Galen* compareth these) they make the meseraicke veines [tab. 2, dddd] which run obliquely betwixt the two membranes of the mesentery, and amongst which there are many small glandules placed to secure their passage and determine in the Guts; not into their cavity, for that is compassed about with a crust, but their little mouths do open into the coate of the gut, from whence they sucke the Chylus as the tendrils of a roote sucke the Iuice out of the earth. Wherefore in the guts called *Ieiunum* and *Ileon* they are more abundant, because they containe a greater quantity of Iuice then the great guts doe.

But they were not onely created to leade away this Iuice, but also to attract it and prepare it for the Liuer, after a manner, saith *Galen*, most like vnto it selfe, because their nature is alike, and they draw their first originall there-from; wherefore after they haue giuen vnto it the beginning or rude forme of blood, and out of them and from the blood the thicker part is drawne by the Spleene through the splenicke branch, [tab. 2, F] they leade it vnto the Liuer. For as Porters doe carry the dressed Corne into the Garner or common Store-house of a Citty where it is prepared for nourishment, so the meseraicke veines doe conuey the aliment laboured in the stomacke to the common place of the creatures concoction, that is, vnto the Liuer, not to poure it into his substance there to bee changed into blood, but to bee referued and laboured in the rootes of the Gate-veine, which are most what on the inside and hollow part of the Liuer, for vnto these rootes the Liuer giueth the power of sanguification as wee haue saide before in the tenth Chapter of the third Booke.

*The double
worke of the
meseraicks.*

Moreover, the same meseraicks by which the distribution is made of the Chylus from the guts to the Liuer, do also carry blood from the Liuer to the nourishment of the guts, yet not at the same time, but when they are empty and want nourishment, and if it happen that both workes concur together, which *Galen* yeeldeth to bee so in the nineteenth chapter of his fourth Booke *De Vsu Partium*, then according to the diuers nature, desire and strength of the drawing parts, the veines of the Liuer snatch the Chylus and the guts blood. For if you make Iron and Strawes into powder together and mingle them, heated Amber will draw away the strawes, and a Load-stone will draw away the Iron by reason of their diuers natures and diuers desires of attraction.

*Why there be
no values at
their ends.
Against Co-
lumbus.*

Now this double attraction could not be performed if the extreame orifice of the veines had values set vnder them as *Columbus* dreamed, but *Archangelus* refuteth him by many arguments, who saith, *Columbus* was deceiued by that crust which is ingendered of the excrements of the third concoction, and compasseth the guts no otherwise then the Scarfe-skinne closeth the extremities or ends of the cutany veines.

Beside, if there were any such values they would hinder the confluence of the humors from the whole body into the guttes, which is made eyther by the constraynt of Nature or of medicine, for saith *Galen De Natural: faculi*: the purgations of the whole body are made by the meseraick veynes, especially by the lower of them; and so much of the right mesentericke branch.

*The left me-
sentericke.*

The left mesentericke veyne [tab. 2, c] is disseminated into the left and middle part of the mesentery, and attaineth that Region of the collicke gut, [tab. 2, ee] which reacheth from the left side of the stomacke euen vnto the right gut.

*The internall
Hemrod-
veynes.*

From this descendeth a notable branch called *Hemorrhoidalis interna*, [table 2, gg] the inward emrod veyne (for the externall proceedeth from the hypogastricall branch of the hollow veyne) and it runneth by the end of the collicke gut vnder the right gut, [table 2, ff] whose extremity (which they call the Fundament) it compasseth about with a few small furcles, by which expurgation is made oftentimes in obstructions of the Spleene, of

foeculent

foeculent blood when it is too abundant, and that in many bodies at certaine and determinate times.

This veyne taketh his originall sometimes from the splenicke branch, from which also the Short or venall vessell issueth: and thus much concerning the branches of the Gate-veine.

Now the difference betwixt the Gate and the Hollow veines is, that the Gate-veine is more lax and soft, the Hollow-veine faster and harder, because the Gate-veine serues rather for attraction then for expulsion, for by it the spleene and the Liuer draw more then they doe expell.

The difference betwixt the Gate and the hollow veine.

On the contrary, the Gate-veine serueth rather for expulsion then for attraction, for by it the blood is expelled into the whole body although it is not a little assisted by the attraction of the members.

The vse of the Gate-veine is to distribute branches which may eyther serue for nourishment as those that leade blood into the naturall parts destituted and forsaken by the hollow veyne, or for the expurgation of some excrement as the splenicke branch which draweth vnto it selfe out of the trunk of the Gate-veine, before the Chylus attaine to the Liuer, a thicke and foeculent humor yet mingled with much laudable Iuice, and the *vas Breue* and the *Hemorrhoid-veine*. Other branches make for the distribution of the Chylus into the gate of the Liuer, in which also it receiueth an alteration and preparation of blood as the *meseraicks* and those veynes which we saide attained vnto the stomacke to draw a part of the Chylus euen from thence.

The vse of the gate-veine and of his branches.

Finally, others perfect the blood as those small veynes disseminated through the flesh of the Liuer, which we called the rootes of the Gate-veine.

Note moreouer that all the Gate-veine lyeth within the boly, neuer attaining vnto the skinne, and therefore his branches are not opened vnlesse haply about the Fundament, where they make the *Emrods*, (to which we doe more often apply *Horsse-leeches*) and in women at the necke of the wombe: and so much of the Gate-veine.

Note.

CHAP. V.

Of the descending trunk of the hollow veyne.



HE hollow veyne called *cava*, because of his large cavity, is by the Grecians called *κοιλία* and *μεγαλη* the greates veine, *Galen* sometimes, as in the fifth chapter of his fourth Booke *de usu partium* calleth it *μεισις*, the greatest veine. *Hippocrates* calleth it *επατινι* *Iecorariam* the liuer veine. This is the common mother of all the veines, except the vmbilicall and the gate veines. It hath one beginning of *Originall*, that is, the seede, for it is made at the same time with the other spermatieall parts which are made or generated together, though some of them be perfected and absolued before others.

The name of the hollow veyne.

His beginning

Another beginning it hath of *dispensation* and *radication*, and that is, the Liuer, and therefore it is said to yssue out of the gibbous part of the Liuer, where his substance is greater and thicker. For although the orifice of the hollow veine at the right ventricle of the heart bee much larger then his capacity in any other place, yet it doth not thence follow that it must arise from that right ventricle as *Aristotle* imagined, and after him *Vesalius*, rather to carpe at *Galen* then that he was mooued thereto by any waighty reason.

For the making and framing of this hollow veine, [table 3, figure 2, and 3. and table 4, shew it,] out of the vtmost circumference of the Liuer in the gibbous patt thereof, [table 2, fig. 2, C C] doe arise innumerable propagations of small veines [table 3, fig. 4, C C C. tab. 4, E E E E] which creeping by degrees toward the middle of the backside of the Liuer, [Table 4, C C] doe meete together, or vnite themselues into larger veines, and these againe into greater, till at length they all passe into the vpper part of the Liuer where it regardeth the right side of the backe into two very notable branches [ta. 3, fig. 3, M, N] the one disperfed into the right, the other into the left part of the Liuer: both which doe determine into one stalke, [table 3, fig. 2, F. fig. 4, A. tab. 4] which is called commonly *the trunk of the Hollow veine*. Wherefore this trunk applyeth it selfe, or inclineth from the right side of the Liuer to the backe side where it entreth, as it were into a *sinus* or cavity, and with a short passage groweth to his substance.

Whereof it is made.

This

This trunke is seated according to the length of the backe, and runs with a streight course through both bellies that so it might conuay vnto the whole length of the creatures blood

Table 3 is the same with Table 13 Lib. 3.

The inocula-
tions of the
gate and hol-
low veine.

(which is the common Aliment of all the parts) laboured in the Liuer in the roots [tab. 3, fig. 4, FF, tab. 4, KKKK] of the Gate-veine; which roots are implicated or intangled with the roots of the hollow veine, [tab. 3, fig. 4, CC, tab. 4, EEEE] dispersed confusedly through the flesh of the Liuer, touching one another in many places ouerthwart. [tab. 3, fig. 4, and tab. 4, shew this] Many roots also of the Gate-veine doe infix or fasten their extremities or terminations into the middle of the roots of the hollow veine, [tab. 3, fig. 4, GGGG, tab. 4, LLL] as on the contrary many ends of the roots of the hollow veine are fastened into the middle of the roores of the Gate-veine. By with Anastomoses or inoculations the blood is transmitted out of one veine into another, and so conueyed into the whole body. For the hollow veine is like a water-pipe full of blood which hath many riuersets some greater and some lesse issuing therefrom and distributed into all the parts. For Nature in this administration is not onely very prouident but also equall and indifferent, and therefore diuided this veine into many small parts that each member might haue his due proportion, that is to say, Aliment answerable to the substance that wasteth away. So hot and soft parts and those that are much exercised do suffer greate expence as the Lungs, and therefore their veine is very large: but colder and harder parts which are moderately exercised, are not so easily dissolved, as the bones which therefore haue very small & slender veines. Betwixt these are all the other parts thereof some haue more euacuation and some lesse, and therefore they want more or lesse nourishment.

Table 4 is the same with 14. Lib. 3. folio 132.

The hollow veine for order sake, and perspicuity we diuide into an vpper trunke [table 3. fig. 3, D, fig. 4, A, tab. 4, above A] and a lower, [tab. 3, fig. 2, at C, fig. 4, B, tab. 4, DD] the vpper piercing through the midriffe and climbing vpward distributeth very many branches into all the superior parts, of which we shall speake in the next chapter.

The descen-
ding trunke of
the hollow
veine.

The descending trunke [tab. 5, K] is lesser then that which ascendeth, because the vpper parts do require more blood; for that many parts in the lower belly contained receiue branches from the Gate-veine. It adhereth on the right hand to the bodies of the rackbones (for on the left side [tab. 5, L] the trunke of the greate Artery lyeth vpon them) and before it depart altogether from the Liuer, it disperseth certaine small branches into his substance which are not in al men of the same number. After it leaueth the liuer, it descendeth inclining something obliquely inward and disposeth from it selfe many branches, of which we will now intreat.

The lower trunke of the hollow veine [tab. 5, K] is diuided into a trunke and branches. From the trunke which runneth vnto the greate racke bone as Hippocrates calls it, or to the holy-bone, [tab. 5, n] commonly there issue foure veynes on each side.

Adiposa sinistra

The first is called *Adiposa sinistra* the left fatty veine. [tab. 5, g] It yssueth out of the left side of the trunke (although *Eustachius* be of the contrary minde) and presently being diuided sendeth one part to the fat, and to the vpper part of the vtter membrane of the kidneies for their nourishment as farre as to the middle of the kidneies. It sendeth also to the glandule which groweth about the kidney and to the midriffe it selfe [Tab. 5, A] which veines on the inside are very conspicuous and vnited with the veines of the midriffe.

The other part it distributeth into the lower part of the foresaide membrane.

Dextra.

The right branch ariseth rarely from the trunke, most what from the vpper part of the middle passage of the emulgent [ta. 5, f.] because the liuer which in this place is somewhat thicke [tab. 5, B C.] and stoppeth vp or intercepteth the way vnto the hollow vein, and therefore the left is for the most part about the right, yet it is distributed after the same manner the left was. And sometimes perforateth the glandule which groweth vpon the kidney with a surcle, which afterward is consumed into the vtter membrane of the kidney. It is very rare if both of them be produced from the Emulgent; more rarely doe the two veins yssue from the hollow veine about and neere the originall of the Emulgent. The vpper of them reacheth a small branch vnto the glandule, the lower is by another surcle ioyned to the branch which runneth from the seede veine of the same side.

Their origi-
nall diuers.

But if the left Emulgent be the higher, then sometime out of it the left fatty veine taketh his originall and the right from the trunke. So sometime on the right hand betwixt the fatty veine and the Emulgent there yssueth another veine which sprinklerh his branches vp into the midriffe, into the vpper part of the substance of the kidny and into the glandule of the same side.

After-

Afterward when the trunk of the hollow veine hath attained vnto the twelfth Rackbone of the Chest, and the first of the Loynes, then yssueth out of it the Emulgent.

The Emulgent which is the second of the foure wee before made mention of, is so called from his office or function. In like manner because it is inserted into the Kidney, it is called *Renalis* the Kidney-veine. The Emul-
gents.

[Table 5 is the same with Table 8. Lib. 3.]

It is the largest of all the veynes that yssue out of the Trunke [Table 9, d] for it is very thicke, yet short because they are as it were drawing stomackes and seruiceable to the Kidnies. In men and Apes they are on either side commonly but one, [Table 5, under d e] notwithstanding sometimes the right Emulgent is double, even from his originall as appeareth in the third Table of the fourth Booke, the first Figure, Charact. 1, and 2. Sometimes it is treble, rarely double on eyther side, and this variety is not onely found in diuers bodies, but also in one and the same, so as the vesselles of the right side differ much from those on the left.

Their originall is seldome directly opposite one vnto the other, least the function or office of one should bee interrupted. But the left is higher then the right in men but not in Dogs, because the left Kidney by reason of the smalnes of the Spleene, standeth higher, whereas the right is borne downe into a lower place by the magnitude of the Liuer. [Tab. 5] The left Emulgent also is larger then the right, because of the Spermaticeall veine which was to arise therefrom. Sometimes also from the lower part of the left Emulgent where it is implanted into the Kidney, there yssueth a small braunch which is transmitted vnto the lower part of the fat membrane, and is oftentimes ioyned with the Spermaticeall. The iourney of both the Emulgents is short and oblique, as appeareth in the third Table of the fourth booke; and about the middle and concauous Region of the Kidney before they get into his cavity, oftentimes in the very middle of their passage they are diuided into two or three, more seldome into foure or fve equall branches, which *Hippocrates* in his Booke *De Ossium Natura*, compares to Anchors fastened in the cavity of the Kidney. These branches of the Veine and the like of the Artery are implanted into deuided parts of the Kidneyes, not ascending, which is rare and then onely when it yssueth out of a lower place, but descending, and those branches are in great numbers subdiuided into the substance of the Kidneyes till they become as small as hayres. Their original

The vse of these Emulgents is to sucke and draw the whacy or serous moysture from the blood and to drayne it, they conuey also therewith a part of the blood it selfe for the nourishment of the kidneyes, but least this blood and whay should returne backe into the hollow veine, Nature hath placed valves or flood-gates, as it is also in the Veines of the Spleene. Their pro-
greffe and di-
uision.

The third veine that yssueth from the descending trunk, is called *Spermaticea* or *Seminalis* the Seed-veine. The Sperma-
tical veines.

The right of these [tab. 5, b] which is sometimes double, ariseth with a swelling original from the vpper side of the Trunke below the Emulgent rarely close to it, from which notwithstanding sometime it receiueh a small branch. The left ariseth [tab. 5, i] almost alwayes from the middest or the lower side. The reason whereof is, because if it should haue straddled ouer the great Artery, [tab. 5, L] so small a veyne would haue beene indangered by his pulsation: for eyther the continuall motion must haue broken it, or at least haue interrupted his office.

There is also sometime ioyned to this left Seed-veine, a branch yssuing from the trunk it selfe. The reason was, because the blood of the Emulgent being waterish, might be assisted by the purity of the blood of the hollow veyne.

These Seed-veynes descending obliquely, and passing through the productions of the *Peritonaeum* or Rimme of the belly about the share-bone, at the head of the Testicles are diuersly contorted and so attaine vnto that which they call *Varicosum corpus* or the *Boddenbody*, leading thither from the whole body the matter of the Seede, as we haue shewed before in the fourth booke.

But in women although their originall bee the same, yet they fall not out of the *Peritonaeum*, neyther doe they reach so farre as to the share-bones, but beeing supported with fat membranes are disseminated part of them vnto the Testicles, part vnto the bottome or soale of the wombe. More.

Moreover they affoord slender furcles to the Rimme of the belly and to the coats which inuest the Testicles.

Lumbaris.

The fourth vessell that departeth from the lower trunke, is called *Lumbaris* or the *Loynes-veyne*. They are two [tab. 5. m m m] or three arising from the lower part of the trunke, which is next vnto the spondels betweene foure rack-bones of the Loynes, and they passe through the holes made for the out-gate of the nerues in the sides of the racke-bones. Their vse is to water and nourish the spinall marrow.

Their vse.

Hippocrates

From these two veynes on each side one ascends into the braine at the side of the spinall marrow, which haply are those whereof *Hippocrates* maketh mention in his booke *de Genitura*, and it may bee they bring a portion of the matter of the seede downe from the braine, whereof *Aristotle* in his Problemes was so confident that he sayth it hath bene seene.

The Illiacke branch.

Muscula superior.

Sacra.

After the departure of these foure veynes the Trunke descending vnto the *holy-bone* [table 5. u] at the fourth racke-bone of the loynes inclineth vnder the great Artery, [Tab. 5. char. 14] that it might neyther bee hurt by the hardnesse of the bone, nor offended by the continuall motion of the Artery, and is diuided into two equall branches called *Rami Illiaci* or the *Illiack branches* which resemble the letter A or T inuerted, which runne obliquely about the haunch and share-bones vnto the Legge. Out of these on cyther side before the diuision doe yssue two veynes. The first is called *Muscula superior* [Tab. 5. n p n p] the *upper Muscle-veyne*, which ariseth euen in the very diuision from the vtter side of the branch; sometime it issueth out of the thumbe of the hollow veyne before the partition, and is transuersely or ouerthwart disseminated through the muscles of the Loynes of the *Abdomen* and through the Rimme of the belly; but their originall is not the same on both sides; and in dogs it is more manifest then in men. The second is called *Sacra*: [tab. 5. o o] or the *holy veyne*. It is but small sometimes single, sometimes double, and it is conueyed through the vpper and forward holes of the holy bone to nourish his marrow.

Afterward the Illiacke trunke on cyther side in his progresse [Table 5. r] is bifurcated into an vtter branch, [Table 5. s] and an inner, [table 5. p] and the latter is smaller then the former: from the inner branch proceed two veynes.

Muscula media

The first is called *Muscula media* [table 5. f f f] the *middle muscle veyne*. It is the outward propagation of the inner branch, and is deriued transuersely [Table 5. F] with many furcles into the muscles of the thigh, which occupy the vtter part of the hips, into the skin of the buttocks, and into the neighbour parts.

Hypogastrica.

The second is called *Hypogastrica*, [table 5. u u] the *veyne of the water-course*. It is the inner propagation of the interior branch. A notable veyne it is and sometimes double, and is diuided manifold, because it was to bee distributed for the nourishment of all the parts almost in the *Hypogastrium* or *Water-course*. One part of it runneth vnto the muscles of the right gut, and maketh the outward Hemrod veynes by which sometimes an abundance of thinne blood, falling hither out of the hollow veine, is auoyded without payne or torments of the belly; sometime also without paine in the Fundament, whereas the blood that issueth from the internall Hemrod made by the branch of the Gate-veine is alwayes painefull in the auoyding. Another part runneth out in men vnto the bladder with greate and large furcles, into the necke, I say, of the bladder and into the Yard. But in women it is but a little lengthened, and being sustained with a fat membrane it disperseth some furcles into the bladder, but many more into the lower part of the wombe and the necke thereof, by which oftentimes in women with child, and as some say in Virgins the courses are auoyded.

The outward Hemrod.

That which remaineth of his interior branch passeth on vnto the share-bone and assumeth vnto it selfe a little rillet from the externall branch, which together make a veyne [table 5. y] which perforateth the Rimme of the belly, and after also the tenth muscle of the thigh, and goeth through the hole of the share-bone.

From the outward.

From the vtter branch of the byfurcation of the Illiacke trunke, [tab. 5. p] which attaineth obliquely vnto the thigh, doe issue three veynes: two before it fall through the *Peritonaeum*, and one after.

Epigastrica.

The first is called *Epigastrica*. [tab. 5. character 1, and 2] It issueth from the vpper part of the vtter branch: sometimes also but more rarely from the Crurall, and offereth branches to the rim of the belly and to the muscles and skin of the *Abdomen*. The chiefe branch of this veyne piercing through the *Peritonaeum* runneth vpward on both sides vnder the right Muscle distributing diuers small branches into the transuers and oblique Muscles, and about the Nauill is ioyned by some furcles to the Mammary veyne that descendeth thither, by which *Bauhine* thinketh that notable consent is made betwixt the breast and the wombe, for those

Veynes

Veines haue their originall from the same deuision, from whence those other haue it which attaine vnto the wombe and the bosome thereof. For their endes or extremities ioine with the extremities of the *Mammary* Veines which descend through the capacity of the chest, and runne as farre as to the middle of the right Muscles, and in their descent do send branches through the distances of the gristles vnto the roots of the Pappes.

The second is called *Pudenda*. [Tab. 5. char. 15.] It ariseth from the inside of the outward bow after it hath gotten ouer the *Coxa*, and is fallen into the thigh, and hath perforated the *Peritoneum* or Rim of the belly. It reacheth ouerthwart to the middle of the share bone, and is distributed with a wonderfull increase, in men into the *Scrotum* or Cod, and into the skin of the yard, in women into the place of modesty, and the neighbour parts.

The third and last is called *muscula inferior* [Tab. 5. char. 13] the lower muscle veine. It issueth from the outside of the vter branch [Tab. 5. c.] and running through the ioynt of the hip, is disseminated into the muscles and skin of that place.

The rest of the propagations which issue from both the trunks [Tab. 5. c.] because they be no longer called *Iliacke* but *Cxprall* Veines, we will intermit till the tenth Chapter.

CHAP. VI.

Of the ascending Trunke of the hollow Veine.

E diuided the hollow Veyne into a descending and an ascending trunk; the descending we haue prosecuted in the former chapter, the ascending we take now for our taske.

The hollow veyne therefore after it hath passed through the neruous part of the midriffe, on his right side by a hole of purpose for it, paceth on through the Chest with his trunk vndiuided [Ta. 6. fig. 1. from A to D. Ta. 7. from a B to H.] euen to the *Inguinum*, that is, the hollownesse about the collar bone. It is a larger trunk then the descending, for it was to leade blood vnto more parts, and for more security is ioined to the midriffe, and to the right deafe eare of the heart. *Laurentius* saith it toucheth the *Mediastinum* likewise. In men there is question whether it do or no; *Vesalius* is against it, but in Dogges and Apes, said *Bauhine*, it doth without doubt: And least in the *Inguinum* it should be hurt by the hardnesse of the bone, and also that it might more safely be diuided into notable branches; there is a glandulous body couched vnder it called *Thymus*, in calues it is called the *Sweete-bread*. In Dogges and Apes (*Galen* saith also in men) a lobe of the Lungs is laide vnder it betweene the Purse of the heart and the midriffe, for their chests are longer then is a mans.

Before the diuision there issue out of the trunk foure branches.

The first is called *Phrenica* [Tab. 7. C.] or the veine of the midriffe, on either side one, which is disseminated through the midriffe in many furcles, and sendeth small branches to the *Pericardium* or purse of the heart, and to the *Mediastinum* or partition of the chest. The right of these issueth sometimes within the cavity of the chest; the left ariseth out of the trunk vnder the midriffe, wherewith also sometimes the Fatty Veyne called *Adiposa* is ioined. Presently the trunk of the hollow-veyne pacing on and perforating the *Pericardium*, and inclining a little to the left hand [Tab. 7. above B.] maketh a brode *sinus* or bosome before the heart ouer against the 8 rackbone of the chest or the top of the ninth; sometimes in the middle space which is betweene the seuenth and the eight racks. Where changing almost his substance and his roundnesse, it degenerateth in the right deafe eare, [Tab. 7. D.] of the heart; or if you will it is on euery side fastened to the right eare which it superficially embraceth. There it is infixed into the right vtricle of the heart, not penetrating very deepe, to the end it might poure blood into it as into a Cysterne.

Eustachius saith that there is a certain membrane set to the fore and inner side of the hollow veyne, which at the middle of the perforation determineth into many fibres, which being diuersly complicated doe make vp or fulfill the rest of the semi-circle, and without coniunction are spread ouer the whole perforation, that so the same membrane might be put forward and repelled backward by the matter that rusheth in or out. But this membrane sometime wanteth that texture or fibres, and resembleth the forme of the Mitted or horned Moone, as it is in the crowne veine. It is also sometime so small and narrow that (as if it were not at all) it cannot be descryed; which haply, saith *Bauhine*, is the reason that I haue not yet obserued it.

Ffff

The

Coronaria cordis
do.

The second branch which issueth from the trunk before the diuision is called *Coronaria Cordis* [Tab. 6. fig. 2. B, tab. 7. E.] the crowne veine of the heart, for, because it compasseth the basis of the heart, like a crowne or garland, the Grecians call it *σφαιριδια*. It sendeth many branches through the viter surface of the heart all ouer the bowell from the basis downeward vnto the *Muero* or poynt, especially through his left side; for, because the substance of the heart is there the thickest it stood in need of more plentifull Aliment, and because it required a thicke nourishment conuenable or agreeable to his substance, therefore it receiueth blood by this Veyne befor it get into the ventricle, where the blood becomming thinner is destined for the nourishment of the Lungs as is commonly conceiued.

His Value.

At the originall of this Crowne-veine there is placed a value or flood-gate like a halfe Moone, resembling that which in the heart of the Infant is set before the first *Anastomosis* or inoculation. This Veine keepeth the blood that is once allowed to the Surface of the heart that it flow not backe into the hollow Veyne, being shaken by the continuall motion of the heart. This *Crowne-veine* (saith *Galen*) is sometimes double; one on the back-side, another arising from the fore-side.

When the hollow Veyne hath allowed this garland to the heart it perforateth the purse thereof againe, and againe resumeth his round figure and becomming much lesser forsaketh the Rack-bones, because vpon them the Gullet and the rough artery doe leane, and runneth through the middest of the lungs where the right part is separated from the left vward vnto the *Iugulum* about the *Thymus*.

But that the Rack-bones and the spaces betwixt the ribs might not be destituted of veines; it yeildeth fourth a small trunk or notable Veine about the heart as it were in the very middest of the body.

The veyne
Azygos

This Veine which is the third before the diuision of the trunk is called *vena Azygos*, or *si-ne-pari*, the veyne without a companion, which we haue before called the *non-parill*. [Tab. 6. fig. 1 C. fig. 2 B fig. 4 B] The reason is because commonly in a man it is but one as also in a Dogge hauing no mate on the other side. It ariseth about the heart betwixt the fourth and fift Racke-bones of the Chest, out of the hinder [Tab. 6 fig. 4 A] and lower part of the hollow veyne as it regardeth the Rackes, but rather to the right hand then to the left.

Vesalius taketh *Galen* very deeply for inconstancy and irresolution concerning the originall of this veyne, to all whose objections *Bauhine* maketh answere, wherewith we could willingly make you acquainted, if we did not thinke that such altercations are fitter for other palats then we desire to be Cook vnto.

In Dogges after the originall it sinketh directly downeward to the sides of the Rackes, but in men it goeth not directly, but is reflected a little to the right hand and backward toward the spine about the right trunk of the rough Artery. When it hath touched the rootes of the Racke-bones it is lifted vp, and passing on to the midst of them it descendeth downeward, so that about the eight or ninth Racke-bone of the Chest it is in the very middest, and runneth downeward vnder the Artery, which beareth vpon it as farre as to the end of the Chest (but deuided before) and with the great Artery peirceth thorough the Midriffe. In most creatures (in which I would haue young men exercise themselves) it taketh his originall from the left side of the hollow veine, and descendeth through the cauity of the Chest on the left side; which indeed in Sheep is alwayes true, but in those creatures which chew the Cud in whome it is double, (which in men is very rare, vnlesse you will say it may be so in those that be Ambidexters, that is, can vse both hands alike,) the right occupyeth the roots of the ribs on the right side, and the left the roots of the ribbes on the left side.

The veyne described by *Falopius*

In like manner sometimes as we are taught by *Falopius* [ta. 8. i.] there is found in men on the left side another veyne [Tab. 8. i.] which performeth the office of the *Azygos*, and then the other on the right side paceth neare the roots of the ribs, but ariseth not about the middest of the racke-bones.

[Table 7, is the same with Table 6, lib. 7.]

This last Veyne taketh his originall from the *Subclavian* branch, and affoordeth small furcles to some of the spaces betwixt the ribs, and sometimes at the fift rib is vnited with the branch which from the Trunk of the *non-parill* is sent ouerthwart [Tab. 8. EE] to the left side ouer against the fift Racke of the Chest, from which also a small branch ariseth vward. Sometimes it ariseth not from the *Subclavian* branch, but out of the Trunk of the hollow

veynes

Veine before his deuision against the third Racke-bone of the Chest, and sendeth small branches vpward to the two first spaces betwixt the ribs. His other surcles it affoordeth to the lower spaces of his owne side, as farre as to the fixt Rack-bone, whither when it hath attayned, it is ioyned with the foresaide transuerse branch, from which surcles are sprinkled into the rest of the distances betwixt the ribs.

Commonly from the trunk of the Veine *Azygos* [Ta. 6. fig. 4. B tab. 7. FF. ta. 8. d] which is seated as it were in the middle of the body; out of the back-ward Region (I say) thereof, as well on the right hand as on the left (but from the right especially) branches are distributed to the distances of the ten lower ribs, [Ta. 6. fig. 4.] sometimes but rarely to all the distances of the ribs, and those branches are called *Intercostrales* [tab. 7. GG] passing along in the distances of the true ribs as farre as to their gristles: but in the distances of the bastard ribs they run out to the muscles of the *Abdomen*.

The Intercostrall veins.

It distributeth also an abundance of small branches to the Gullet; sometimes and that not seldome, when it ariseth from against the fourth racke-bone of the Chest, it sendeth a branch vpward, [tab. 8. at the upper d] from which surcles are deriued with a wandring passage to the foure vpper ribs.

The propagations of the *Intercostrall* Veines doe fall also out of the Chest, [ta. 8. XXX] and on both sides in some places are vnited by inoculation [Tab. 8. YYY] with the surcles of the lower *Chest-veine*. Whence it is that in the *Pleurisie* we do not alwaies vse, as *Vesal. us*, to open the Veine on the right side, but finde it profitable to Phlebotomize the inner Veyne of the cubite on the same side the paine is. For because of this vnion, reuulsion is made more commodiously and more easily.

When the Trunke of the Veine *Azygos* hath attayned to the eight and ninth ribbe, sometimes to the tenth saith *Hippocrates* in his booke *de natura ossium*, it is deuided about the Spine into two boughes: a right and left, which *Falopius* and *Eustachius* did first obserue, [Ta. 6. 00] both which doe creepe downward and passe through vnder the diuision of the Midriff.

2 boughes of the Azygos

The one of these, and for the most part the greater, on the right hand determineth most what with one branch into the back-side of the hollow Veyne, neare the beginning of the Emulgent. Sometimes into the middle of the Emulgent, [Tab. 8. EF] where it bringeth forth the Seede-veine. Sometimes againe it is reflected in the cauity of the backe, and vnited againe with a small branch yssuing from the Emulgent. Sometimes also this left branch is deuided into 2. branches, one of which runneth vpward [tab. 6. fi. 4. ED] the other downward by the roots of the ribs, and affoordeth branch is to the distances betwixt them.

The left.

The right bough approaching to the hollow Veyne, is sometime ioyned thereto about the Emulgent, sometimes it is ioyned to the Emulgent it selfe, but that rarely: Sometime to the first Veyne of the Loynes, but most commonly it is implanted into the last [Tab. 8. *] of the Loynes. We also finde in some bodyes a small branch running obliquely by the Racke-bones, and penetrating or making way into their cauity. Whereupon we conclude, that in the beginning of a *Pleurisie* the Veine of the Hamme or that of the Foote called *Saphena* may be opened.

The right.

Nota.

Hence also it is that many *Pleuriticke* Patients are critically purged, Nature auoyding an abundant quantity of Pus and Matter by the vrine. Moreover it hath beene obserued that in those which we call *Empyici*, the Matter hath beene conuayed through the venall Artery of the Lungs into the left ventricle of the Heart, thence into the great Artery, and so into the Kidneyes, and continually auoyded by the vrine. Wherefore this distribution of the Veyne *Azygos* and his vnion sheweth how the Chest may commodiously be purged by the vrine. The Rack-bones also along which it runneth and the *Mediastinum* receiue surcles herefrom.

How the chest is purged by vrine.

Now whereas *Amotus Lusitanus* in his Centuries, and with him *Hollerius* affirme that the beginning of this Veyne hath Membranes or Flood-gates, such as are found in the orifices of the vesselles of the heart which admitte the ingresse of the bloud out of the hollow Veyne into this *Azygos* but hinder the egress; they are much deceived saith *Bauhine*: for I could neuer obserue any such eyther in men or in brute beasts. Adde hereunto that if you open this *non parill* below, presse it out and put a bugle thereinto, when you blow the bugle, not onely this Veyne but the hollow Veyne also will swell. Their opinion therefore falleth to the ground, who think that when a Veine is opened in the arme, though the hollow Veyne be emptyed, yet there is no depletion made out of the *Azygos*, because those values do hinder the egress of the blood into the hollow Veyne.

No valves in the Azygos.

Ffff

The

*Intercoſtalis
ſuperior.*

The fourth veine that ariſeth out of the trunke before the diuiſion is called *Intercoſtalis ſuperior*, the vpper Intercoſtall veine. [Tab. 6, fig. 1 F. Tab. 7, K] There is one of them on each ſide ariſing from the ſubclavian branch neare the beginning of the Iugular veine. [Tab. 7. S T.]

Sometime the right veine ariſeth from the trunke, and the left from the branch. It is reflected vnder the Artery of the arme, and for the moſt part (eſpecially on the right ſide) is diuided into two branches which are diſtributed ſometimes into two, ſometimes into three diſtances of the vpper ribs which are ioyned with the mammary branches [Tab. 7, L L] which creepe through the griſtles. This veine is then wanting when the *Azygos* affoordeth branches vnto all the diſtances of the ribs.

In like manner from all the Intercoſtall veines there iſſue certaine ſmall ſurcles which inſinuate themſelues into thoſe holes of the rack-bones, out of which the nerues do iſſue for the nourishment of the bones and the ſpinall marrow.

*The diuiſion
of the trunke.*

The trunke of the hollow veine being deliuered of theſe veſſels [tab. 7, H] aſcendeth directly vnder the breſt bone aboue the great artery at the Iugulum, where it is ſupported by the *Mediaſtinum* and the *Thymus*, and is diuided into two notable bowes, [Tab. 7, II. tab. 8, CC] one of which runneth to the right ſide, the other to the left, and as long as it remaineth in the Cheſt it is called *Subclavius*, *Columbus* and *Falopius* call it *Axillaris*.

Table 8 is the ſame with Table 7, Lib. 6.

*The ſubclavian
branches.
Mammaria
deſcendens.*

From each ſubclavian branch ſome veins iſſue from the lower part, ſome from the vpper. From below before the ſubclavian is diuided do ariſe foure veines or branches. The firſt is called *Mammaria deſcendens* [tab. 6, fig. 1, EE. tab. 7, LL. tab. 8, I] The deſcending mammary veine whoſe originall is diuers, for ſometime it ariſeth from the fore and middle part of the byfurcation, ſometime from the roote of the ſubclavian, ſometime the left ariſeth from the ſubclavian and the right from the byfurcation. Sometime there is but one which ariſeth out of the middle of the trunke of the hollow veine before the diuiſion, which when it hath attained vnto the breſt bone is diuided into a right and a left.

This mammary veine inclining forward and running vnder the breſt-bone, getteth out againe at the ſides of the griſtle, which we called the breſt-blade, and creepeth along the vpper part of the *Abdomen*, allowing ſurcles thereto, and in his deſcent affoordeth ſmall branches to all the griſtly diſtances of the ribs (for the bony diſtances are ſupplied by the *Azygos*) which are ioyned with the extremities or end of all the intercoſtall veines. A part of this mammary veine getteth out of the Cheſt to the muſcles that lye therevpon and when it hath diſtributed his ſurcles part vnto the paps, part vnto the reſt of the breſt, it is led downward vnder the right muſcles of the *Abdomen*, to which his branches are tyed and the extremities of his diuiſions do vnite [Tab. 7, M] with a ſmall Epigaſtricke Veine [tab. 7, e] which aſcends vpward. Other ſmall veſſels alſo runne vnder the ſkin to the *Hypochondria*, which veſſels are made partly of the commixtion of the Intercoſtall Veines with the mammary, partly of thoſe which nourish the Intercoſtall muſcles, with which alſo others are vnited which aſcend from the groynepward.

Mediaſtina.

The ſecond Veyne iſſuing from the ſubclavian before his diuiſion is called *Mediaſtina* [Tab. 2, lib. 6, Q] which ariſeth from the trunke, ſometimes from the left ſubclavian againſt the internall Iugular. Sometime it is but one veyne and that large derined downward aboue the hollow part of the Lungs and aboue the purſle of the heart, and is diſſeminated thorow the *Thymus* and the *Mediaſtinum*. Sometime they are two ſurcles which runne through the *Mediaſtinum*, one of which is ioyned with the aſcending Veines of the Midriffe, the other paſſing downward with the left nerue of the midriffe, is inſerted into his fleſhy ſubſtance, and this inſertion is better perceiued in young bodyes then in Auncient.

Cervicalis.

The third Veyne is called *Cervicalis*, [Tab. 6, OO. Tab. 7, NN] or the necke-veine. It is not very large, and runneth obliquely vpward and backward by the laterall proceſſes of the racke-bones of the necke, and paſſeth the holes made in them, affording ſurcles to the muſcles that lye next vpon the bones. It ſendeth alſo others through the holes made for the nerues to nourish the marrow of the necke, and there is conſumed. *Laurentius* thinketh it aſcendeth vnto the braine.

*Muſcula in-
ferior.*

The fourth is called *Muſcula inferior*, [tab. 7, O] the lower Muſcle-veine which ſome

Sometime issueth out of the externall Iugular, and is distributed through the vpper muscles of the brest and the lower of the necke. And these foure issue from the *subclavian* branch before it get out of the cavity of the Chest. Afterwards when it is gotten out of the Chest, [tab. 8. P.] it changeth his name and is called *Axillaris*. From the axillary veyne before it be divided, two veines are propagated.

The first is called *Scapularis interna* [tab. 7. Q.] the inner blade veine and is distributed through the muscles on the blade, and those that are neare them, where also those small branches doe appeare which passe through the glandules that are vnder the arme pits. *Scapularis interna.*

The second is called *Scapularis externa* [tab. 7. d.] the vpper blade veine, because it passeth into his gibbous and vpper part: the other part of it runneth betweene the flesh and the skinn. *Scapularis externa.*

Afterward the axillary branch is divided into two veines, [tab. 6. H I. tab. 7. a m.] one superior which is called *Cephalica*, [tab. 7. a. tab. q.] or the head veine, the other inferior [tab. 7. m. tab. 8. r.] called *Basilica*, of both which we shall speake more in the ninth Chapter. In the meane time you shall know that from the trunk of the *Basilica*, two veines doe issue. *Cephalica Basilica.*

The first is called *Thoracica superior* [tab. 7. P P. tab. 8. f.] the vpper chest veine, which applyeth it selfe to the brest, and is distributed into the skin and the muscles which couer the brest: in women it yeeldeth a great number of veines vnto the dugges. *Thoracica superior.*

The second is called *Thoracica inferior* [tab. 7. R R. tab. 8. t t.] the lower chest veine. It runneth all along the side of the chest and his branches are inoculated [tab. 8. y y.] with the branches of the veine *Azygos* [tab. 8. X X.] which issue out of the chest (wherefore wee may draw blood in a pleurisie out of the axillary veine of the pained side) and are distributed through the broad muscle of the arme. This lower chest veine ariseth sometimes out of the vpper, sometime out of the *Basilica*. And thus much for the veines arising from the lower part of the *subclavian* branch. *Thoracica inferior.*

From the vpper part of the *subclavian* branch arise three veines on each side. The vpper muscle veine and the two Iugulars, one externall, another internall, which ascend vnto the sides of the necke, and at whose orifices there are two valves which hinder the relapse of the blood, for otherwise the vpper parts should haue beene defrauded of Aliment.

The first I said was called *Muscula superior*, [tab. 7. b b. tab. 8. o.] the vpper muscle veine. It ariseth neare the externall Iugular [tab. 8. n.] and is diuersly dispersed into the skin and muscles that are on the backside of the necke. *Muscula superior.*

The second is called *Iugularis externa* [tab. 6. fig. 1. II. tab. 7. T T. tab. 8. M] the externall Iugular veine. It is one commonly on each side, yet sometimes double from the originall, sometime it groweth double in the middest of his passage. It runneth vpward vnder the skin affoording furcles to all the outward parts of the necke, of the head and of the face, on his owne side, and for the most part vnder the roote of the eare it is divided into an vpper and inner branch, as we shall say in the next Chapter when we speake of the Veines of the face. *Iugularis externa.*

The third and last is called *Iugularis interna* [tab. 6. fig. 1. K K. tab. 7. T T. tab. 8. m.] the internall Iugular Veine. In man because of the abundance of his braine it is greater then the externall, but in dogs lesse. At the side of the rough Artery it sendeth small furcles thereto and to the neighbour membraness, thence it climeth vnto the chops, and hard at the head is byfurcated or divided, and there we leaue it. *Iugularis interna.*

CHAP. VII.

Of the veines of the Face, the Eyes, the Nose, the Teeth, and the Throttle.

WE said euen now that the externall Iugular Veine was vnder the roote of the Eare divided into an vpper [tab. 7. y.] and an inner branch. [x] The inner runneth to the muscles of the mouth, the chops, and the bone *Hyois*. In the mouth it maketh those two notable Veines vnder the tongue [tab. 7. t] which from their colour rather then from their figure are called *Ranina* the Frogge-Veines, which Veines in diseases of the mouth, the heate of the throat and the squinsie are opened for deriuation after euacuation and reuulsion made by the Veine of the Arme. From it also are many furcles deliuered ouer to the Larynx or Throttle, to the glandules there-to growing and to all the parts of the chops for their nourishment. Afterward appoaching

ching to the skull it entreteth thereinto through a hole of the temple bone neare the mammillary proceffe and so goeth into the *sinus* of the *dura mater*. There also passeth a vein on the outside of the orbe of the eye, by the hole of the wedge bone which is likewise disseminated into the *dura mater*.

The vter branch.

Vena Frontis.

The vter branch creeping vp the skin, and the muscles of the head vnder the care is supported with Glandules, and diuided into two progagations. One of which runneth to the forehead of the face [tab. 7. 2.] and is allowed to the nose and the puffed of the cheek, and in the middle of the forehead it is ioyned with the branch of the other side, and maketh the veine of the forehead [tab. 7. a.] which in some cases is wont to be opened. Another progagation thereof runneth by the side of the head, and sprinkleth veines partly to the temples [tab. 7. a.] partly to the Nowle of the head. [tab. 7. *] The branches of this exterior veine are diuersly mixed in the face and the sides of the head: from which some small furcles are distributed into the sutures of the scull and the small holes or perforations thereof. And so much of the externall Jugular, now we come vnto the internall, where we left it at his bifurcation hard at the Head, in the end of the chapter going before.

CHAP. VIII.

Of the Veynes disseminated through the Braine.

The inner Jugular.

The first of the Braine.

The second

The third,

The 4. and 5.

Vesalins and Platerus adde a sixt.

Falopius.



THE inner Jugular veine when it attaineth on the backside to the Basis of the Scull is diuided into two branches, whereof the one being the larger is carried backward, the other which is the smaller is carried forward.

The first is led along the basis of the scull with the lesser branch of the sleepey artery, and when it hath afforded furcles to the Muscles which lie vnder the gullet, it getteth into the scull and so into the *sinus* of the *dura mater*, through the first hole of the Nowle-bone which was prepared for the first paire of sinewes.

The second which leaueth the sleepey Artery, runneth forward after it hath sent a furcle to the organ of Hearing through the fourth hole of the Temple bone, it entreteth into the scull by the seuenth hole of the Wedge-bone and walketh through the basis and the sides of the *dura mater* or thicke membrane leading them Aliment, because they are far distant from the third *sinus*: from these also do yssue some furcles which creepe vp the *Pia Mater*.

Bauhine accounteth the third veine of the braine to be the inner branch of the externall Jugular which diuideth it selfe into three furcles, and entereth into the scull by the hole of the temple-bone which is neere the Mammillary proceffe, of which we spake in the former chapter.

The fourth and the fift Veynes of the Braine he saith do proceed from the same interior branch of the externall iugular, the fourth entreteth into the scull out of the orb of the eye by the second hole of the Wedge-bone, the fift out of the capacity of the Nofethrils by the hole of the *sciue* or spongy bone. The vse of these two latter Veins is to nourish the fore part of the Braine, because vnto it the third *sinus* doth not reach but determineth neere the distinction of the Mammillary processe. These Veynes also because they are small haue no Arteries ioyned with them, yet there is a furcle sent thither from the first artery of the Braine.

Beside these five Veines Vesalins and Platerus affirme, that there is another which they call The first Veine of the Braine, which is the end of the Neck-bone. For when the Neck-veine cometh vnto the top of the necke that which remaineth of it, together with the Artery his companion, passeth through the third hole of the Nowle-bone, which postern was particularly made for this priuat vse: or if that be wanting through the second, which was made for the seuenth paire of sinewes, and determineth on both sides into the *sinus* of the *dura mater*.

Bauhine ingenuously confesseth, that he could neuer finde this passage and yet makes mention of it, because other men should not want occasion to enquire after it. For saith he, the Necke-veine is partly consumed or taken vp in the perforations of the rackbones of the necke, yet so that it toucheth not the first racke: partly his branches are disseminated into the backside of the neck, having first transmitted some vnto the Muscles in that place (as we are taught by Falopius) which Veynes are vnited together among themselves, and together also with others which are sent out of the *sinus* of the *dura mater*, through the large hole of the scull, for there are many veines which from the *dura Meninx* are propagated to the outside of the head

head through the Sutures comming from without : which saith *Falopius* gave occasion to some to thinke that they were outward veines which went in through the holes of the Scull into the *sinus* of the *dura mater*, whereas they are rather internal Veines which get out at those holes and are ioyned with the externall.

The vse of the veines of the Braine which are in innumerable multitudes disseminated into both parts thereof and into his marrow (and although some of them be so smal, that he which is not quick-sighted cannot perceine them, some of them are conspicuous enough) the vse I say of them all is three-fold. The first to minister vnto the Braine his Aliment, that is Blood, & that in great aboundance, because the quantity of the Braine is great. And truly that there is abundance of Blood in the head doth easily appeare in dissections after inflammations of the Braine.

The vse of
the Veines of
the Braine.

Their second vse is to transmit vnto the Braine naturall spirit from the Liuer for the nourishment of the Naturall spirit which is in the Braine.

The third, that together with the naturall spirit the naturall soule, which is called also *Vegetativa* or the growing faculty, might be conducted into the braine; for because in the braine there is a faculty to draw, retaine, concoct and expell the Aliment or superfluities thereof, it is very necessary that it also should haue in it the naturall Soule either of it selfe or deriued from other where. But because the seat of the naturall soule is concluded to be in the Liuer, it must needs follow, that it can no otherwise be conueyed to the braine but through the veines.

Archangelus

Archangelus addeth a fourth vse of these veines of the Braine, and that is, that by the veines as also by the Arteries, the seede might be made fruitfull. For *Hippocrates* saith in his booke *de Genitura*, that those are barren and vnfruitfull whose Veines behind their eares are cut or diuided, and his reason was because he thought that a great part of the seed fell neere the eares from the head into the spinall marrow. But if the passage be stopped vp by a Cicatrice growing vpon the wound of the vessell, then shall the current of the seede be interrupted.

Concerning which difficulty and the interpretation of *Hippocrates* meaning, we haue disputed at large in the fourth question of the fift booke, and therefore we will not trouble the reader heere with fruitlesse repetition, but send him thither if he desire to be further satisfied concerning that matter.

Beside the veines and other vessells of the brain. It hath a priuate vessell which is called the *sinus* of the *dura mater*; full of blood, but beating like an Arterie, into which three veines and two Arteries do powre their matter, which sinus according to the diuers course and inclination thereof is diuided into foure: greater indeed then the veines that attaine vnto the scull and more capacious, not round but triangular. The whole sinus consisteth of three ribbes all of equall longitude, and of the fourth part of a circle incurued. From these do arise branches or passages like vnto veines, and doe distribute blood as well Vitall as naturall into the substance of the braine. But because we haue entreated sufficiently hereof in our chapter of the membranes of the braine which is the seauenth of the seuenth Booke, where also we haue exhibited the figure thereof vnto you, we will heere put an end to the veines of the Braine, and passe on vnto the veines of the Arme.

The sinus of
the Braine.

CHAP. IX.

Of the Veines of the whole Hand in the large Acceptation.



E said before that the Trunke of the Hollow-veine vnder the breast-bone at the very *Iugulum* or sticking-place [Ta. 9. fig. 1 H] is diuided into two notable branches, [II] one of which runneth to the right hand, the other vnto the left, and as long as it is within the Chest it is called *Subclanius*, but after it is gotten out because it runneth to the arme-holes it changeth his name and is called *Axillaris*, from which diuers Veines do yssue, of which we haue spoken before: but the Axillary veine departeth into two branches, one vpper which is called *Cephalica* [a] or the Head-veine, the other lower which is called *Basilica*, [m] so that both of them haue the same Originall, and of both of them will we intreat in this chapter.

The trunke of
the hollow
veine.

The *Cephalica* or head-veine [a] is the vpper branch of the *Axillary*, but it issueth from the externall *Iugular* veine. It is called *Cephalica* because it is wont to be diuided or opened in diseases of the head. It is also called *Humeralis* or the veine of the arme, because by the arme

Cephalica

it descendeth vnto the hand. It is also called the *Outward* veine, because it runneth on the outside of the Cubit. For passing along by the top of the arme it runneth vnto the cubit and the hand betwixt the fleshy membrane and the coate of the muscles, and before it hide it selfe vnder the arme it sendeth out sometimes one, sometimes two little branches [dd] which are distributed through the muscle of the arme called *Deltoides* and the skinne wherewith it is covered: then it passeth to the outside of the Cubit in which very place some make the beginning of the *Cephalica* veine, and call that part about it the *Humerary* veine. There also it is very conspicuous euen without sectiō, except the man be either too fat or haue smal veines. But in the descent, there issue from it small veines as far as to the ioynt of the Cubit or the elbow, part directly, part creeping obliquely into the muscles of the arme and into the outside of the skin, so that some-times it seemeth to vnite it selfe [f] with the branch of the *Basilica*, which is distributed lifewise in the skin.

The diuision
of the *Cepha-*
lica.

Sometimes a branch is sent to the inner muscles of the Cubit, which branch in men is most commonly wanting: but when it cometh vnto the ioynt or bow of the Cubit, [f] it is diuided neare the externall protuberation of the arme into an inner and an out-ward branch.

The inner
branch.

The inner at [b] being led along vnto the middest of the bent of the Cubit vnder the skin ioyneeth or vnith it selfe with a branch of the *Basilica* at [t] and so maketh that veine which is called *Mediana* or the middle veine [a]. But sometimes this branch is scarce conspicuous, whereas the veine opposite proceeding from the *Basilica* is very manifest, and sometimes it is quite contrary.

Mediana.

The veine called *Mediana* [a] hath his name from his situation, and it is also called *Communis* or the *Common* veine, because it is formed of branches of the *Cephalica* and *Basilica* running both into one. [b] This coniunction is made commonly in the very bought of the arme, sometimes much lower not far from the middle of the length of the Cubit, and by *Anicen* is called *The blacke-veine*. It runneth obliquely downward through the middle Region of the arme, & about the *wand* sprinkleth surcles on either hand, sometimes also it assumeth others frō those which runne through the inside of the Cubit. But about the *Radius* or *wand* [below p] it is diuided into two [z] branches. The vter [y] sendeth a surcle marked with [d] to the inside of the wrest toward the Thumbs, and is mingled with others. [q z] The remainder runneth out toward the Region of the thumbe and forefinger which some call *Sallustella*; but commonly the Chyrurgions call it *Cephalica*, others *ocularia*. The inner branch [e] is spent in many surcles betweene the fore and middle fingers, and some deale into the ring finger.

Some thinke this to be that which *Anicen* calleth *Syele*. But the truth is, that the distribution of the veines which run vnder the skin of the hand is so diuers, yea in the Cubit it selfe, that the same mans right arme duth scarce agree with his left, but two men alike you shall not find among a great many, and therefore their deliniation is harder to score out.

The vter
branch.
Funis Brachij.

The vter branch of the *Cephalica* by *Anicen* called *Funis Brachij*, the Chord of the arme [I] goeth obliquely by the *Wand* into the length of the Cubit on the outside, sprinkling small veines as he goeth [K] into the skin. But when it hath attained vnto the middle of the wrest on the inside neere to the *vlna* or *Ell* [l] there is ioyned to it a small branch of the *Basilica* [X] wherewith being increased it climbeth ouer the out side of the wrest, and with a small branch entangleth that part of the hand which lieth before the ring and the little fingers, and maketh that veine with the Arabians call *Syele*, we commonly *Sallustella*, which in the backe of the hand appeareth before the fingers. The section of this veine in the left hand is held by the Arabians and by many other Practitioners in physicke to be of great auaille in melancholy diseases. Sometime this branch of the *Cephalica* is wanting & his stead is supplied by a branch of the *Basilica* [x] which runneth throughout the length of the Ell, sometime it is supplied by branches issuing from the *Mediana* into the skin.

Sallustella.

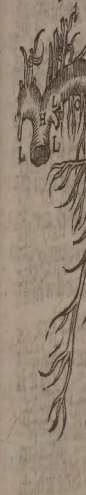
Basilica.

The lower branch of the Axillary veine is called *Basilica*. [Ta. 9. mm] It is greater and larger then the *Cephalica*, and deuided into more surcles, many call it *Axillaris*, the veine of the Arme-hole, some the *inner veine of the cubit*, because it descendeth by the inside of the cubit.

Hepatica.

Lienaris.

Amongst practitioners it changeth his name in respect of the Arme, for in the right arme it is called *Hepatica* or the *Liuier-veine*, because it is opened in diseases of the *Liuier*. In the left Arme it is called *Lienaris* or the *spleene-veine*, because it is opened in diseases of the *Spleene*. It passeth along the inside of the arme among the muscles which compasse the bone, and at the Arme pit is entertained by many Glandules, where also it is diuided into diuers propagations:



f. A threefold diuision of the arme. *Cephalica* running c. l. The third branch l. m. The veine ca. ches to the muscle. with the fourth ne. wayes accompanie. other branch that. of the *Basilica* whi. going to the inner. finger ioyning it le. upper z. the weth. *Basilica* branch at. of the *Mediana* rei. the outside of the l. towards the midd. which ioyneeth wi.

propagations: the chest, and of. veine, runneth n. chest, and where. speake plainer, f. four on each f. Hence any n. ther the veine. It sendeth.

Table 9. Figure 1. sheweth the Cephalica and Basilica Veines & their branches.

TABVLA. IX.



H The by-partition of the hollow veine vnder the breast bone neere the *Iugulum*.

I, The subclavian veine, on either hand, about the vtter and inner *Iugular* veine, with that which is called *Cervicalis* or the Necke-veine.

K, The vpper intercostall veine.

LL, The Mammary veine.

O, *Muscula*, which goeth to the lower muscles of the necke and the vpper of the Chest.

P, A veine which reacheth vnto the muscles that lie vpon the Chest vnto the skin of that place, and vnto the dugges.

Q, A veine that goeth vnto the backe side of the chest to the hollow part of the blade and to the neighbour muscles.

* Small veines to the glandules vnder the Arme-pits.

R, A branch distributed along the sides of the Chest, especially into the broad muscle.

a, The Humerary veine called *Cephalica*.

b, A branch vnto the backward muscles of the necke.

dd, Branches from the *Cephalica* to the muscle that lifteth vp the arme.

ee, Small veines out of the *Cephalica* dispersed through the skin of the arme, & the muscles that lead the arme backward.

f, A threefold diuision of the *Cephalica*. g, The first branch to the muscles arising out of the externall protuberation of the arme. h, A branch of the *Cephalica* which helpeth the *Median* veine. i, The third branch of the *Cephalica* running obliquely about the *Wand*. k, Surcles that runne vnto the skinne from this third branch. l, The third branch at the wrist ioyned with the branch of the *Basilica* noted with x, their coniunction is at l. m, The veine called *Basilica*. n, o, A branch running by the heads of the muscles of the cubite at n, also branches to the muscles themselves at o. p, A notable branch of the *Basilica* carried obliquely and accompanied with the fourth nerue. q, The diuision of the *Basilica* into two branches, and that which is noted with q, is alwayes accompanied with an artery. r, The deepe branch of the *Basilica* bypartited or diuided into two. s, The other branch that goeth to the flesh and the skinne. t, A branch of this to the skinne of the arme. u, That branch of the *Basilica* which with the *Cephalica* branch b maketh the *Median* veine at cc. v, A branch of the *Basilica* going to the inner head of the arme. xx, A branch out of the former going to the wrist, and toward the little finger ioyning it selfe with the *Cephalica*. y, A branch nourishing the skinne at the outside of the cubit. zz, The vpper z sheweth a propagation out of the branch of the *Basilica* marked with t, the lower z another out of the *Basilica* branch at x running to the inside of the arme. cc, The common veine called *Mediana*. d, the partition of the *Median* veine about the wrist, but the d is set a little too low. e, s, The outward branch heereof going to the outside of the hand at y, from which yssueth a small branch vnto the inside of the hand at s. z, Another branch towards the middle and ring Fingers. g, The veine of the Thumbe which nourisheth the Hillocke or mountenet which ioyneth with the veine noted with s.

propagations: the most noble whereof is disseminated into the muscles which lye vpon the chest, and of these againe the largest called *Thoracica inferior*, [tab. 9. k.] the lower chest veine, runneth neare the ribs, and receiueth the rootes of those veines which issue out of the chest, and whereby (we said before) the distances betwixt the ribs were nourished: or to speake plainer, the mouth of the veine *Azygos* doth ioyne in three branches, sometimes in foure on each side with the mouth of the chest-veine. [tab. 8. xxx. with yyy.]

Hence any man may gather what veine is to be opened in a *Pleurisie*, that is to say, whether the veine on the side inflamed or on the contrary side.

It sendeth also a small branch vnto the muscles which extend or stretch the cubit, [tab.

Tab. 9 n] against which another veyne is disperfed from his oppofite into the Glandules. From the fame backefide another veine [*Tab. 9 O*] is fent to the fame mufcles, from which fome furdles are fprinkled into the fkinne of the Arme on the outfide. Vnder this a notable propagation [*Tab. 9 p*] runneth obliquely downeward vnder the bone of the Arme toward the outward protuberation together with the fourth nerue of the arme.

The diuifion
of the *Bafilica*.

Profundus.

His diuifion.

Subcutaneus.

His diuifion.

Afterward this *Bafilica* not farre from his egreffe out of the cauity of the Cheft, is diuided into two trunkes [*Tab. 9 fig. 1 q r*] and thofe almoft equall, one of them is called the Deep veyne, the other the *Cutany* or *Skinne* veyne. The Deepe veyne becaufe it lyeth or lurketh in the bottome is called *Profundus* [*q*] or the trunk which lyeth low. It is faftned to the Axillary Artery which runneth into the arme [*ta. 9 fig. 2 n*] and their diftributions are almoft alike. It is alfo accompanied with the fourth branch of the third nerue of the arme, and defendeth through the middeft thereof vnder the *Median* or common veine, and when it hath overcome the ioynt of the cubit; [*tab. 9 **] it is diuided into an vtter and an inner branch, which receding or departing a little one from another, and fprinkling furdles into the mufcles, do defcend together with tendons of the mufcles of the fingers vnder the tranfuerfe ligament, and are diftributed into the infide of the fingers. The vtter, which defcendeth along the *Radius* or wand lendeth 2. fmall branches to the thumbe and the fore-finger, and one to the middle finger. The inner, is tyed to the bone of the cubit and is deuided alfo into two; and from thefe one branch is afforded to the middle finger and 2. to the Ring and little fingers. The firft to the mufcles of the outfide of the hand, the 2 to thofe on the infide.

The other trunk of the *Bafilica* [*tab. 9 r*] is called *Subcutaneus* or the skin-veyne, becaufe runneth immediately vnder the fkin throughout the length of the arme on the infide, and in his paffage difperfeeth many branches; afterward a little about the inner protuberation of the arme where it is no leffe conspicuous before diffection then the *Cephalica* is about the cubit; it is diuided into a forebranch [*tab. 9 t*] and a hinder branch. [*tab. 9 a little about u*] The fore branch running obliquely through the middle of the bought of the cubit, maketh together with the inner branch of the *Cephalica* [*tab. 9 H*] vnder the bent, the Common veine. [*tab. 9 a*] Yet fometimes this branch which runneth vnto that common-veyne is farre larger or leffer then the branch of the *Cephalica*, fometimes alfo either of them are double. The pofterior branch of the *Skin-veyne* [*tab. 9 u*] is diuided into two neere the inner protuberation of the arme, [*vnder u*] and the vtter and greater of thefe [*xx*] defcendeth along the *vlna* or Ell vnto the wrefte, and fendeth a branch downeward [*xx*] neere the wrefte vnto the little finger, and againe meeteth and ioyneth [*l*] with another branch of the *Cephalica* [*i*] paffing that way, and this after the manner we haue before fpoken of vs diftributed into the out-fide of the hand. From this branch alfo a furdle is diffeminated vnto the fkin [*y*] and the back-parts. There are alfo other branches [*the lower z*] yffuing out of this propagation [*u*] diffeminated into the fkin of the infide, which branches are diuerfly mixed now vniting themfelves, againe departing one from another, affuming furdles from the propagation noted with [*x*] and communicating others vnto it.

Burften veines
in the armes.

An idle curio-
fity.

Finally, from that branch of the *Bafilica* [*tab. 9 t*] which maketh the *Mediana* or common veine, out of the lower and middle part thereof yffueth another notable veine [*at the upper z*] which defcendeth fometimes direftly fometimes with a crooked paffage vnto the wrefte, and is diuerfly vnited with other neighbour veines. Hence it is, faith *Vesalius*, (and the obferuation was worthy of the Authour) that fometimes the infide of the cubit is troubled with broken or boddene veines as the calfe of the Leg is. The furdles of that notable veine fometimes direftly or in a right line, fometimes overthwart, fometimes obliquely, fometimes againe vnited and fometimes diuided, doe grow vnto the fkin of the infide of the hand.

From thefe fo diuers coniunctions of veines, efpecially when the beginnings of the *Cephalica* and the *Bafilica* is one and the fame [*Table 9 m n out of I*] we may eafily gather how vnprofitable a thing it is to be fo fcrupulous and anxious in the choyce of veynes in one and the fame fide of the arme: wherefore when wee are refolved to open a veyne, and a veyne of the arme, as alfo on which fide it fhall be performed, it will be out of doubt the beft to ftrike that veyne which vpon the binding of the arme will bee moft turgid and full. For there are three places to let bloud in the arme, according to *Galen* in his Booke *de curati-one per fanguinis miffionem*, the interior, the exterior and the middle. Wherefore when we come to open a veyne we find all three places equall or two onely, or all vnequall, fometimes alfo one of them is hidden and fometimes two. The fection of the inner veyne hee efteemeth profitable for thofe that haue any affection in the lower parts of the necke. The

fection

section of the vter veine when the superior parts as the face and the head are diseased. The section of the middle veine communicateth with both, for it is compounded of veines issuing on both sides.

To conclude, there are found in the *Cephalica* and *Basilica* certaine values, but I containe my selfe, for because we shall meet with them also in the foot, I thinke it best to referre their description vnto the end of our discourse of the Veynes.

CHAP. X.

Of the veynes of the whole Foote in the large acception.

THE hollow veine in the lower Belly descending vnto the Holy-bone, when it cometh vnto the fourth racke-bone of the Loyues, where it lyeth vnder the great Artery [tab. 10 O] is diuided into two equall trunks: one of which goeth to the right legge, the other to the left, which trunks before they get out of the *Peritoneum* are called *Iliaci*, [tab. 10, betwixt O and G] and presently both the right and the left are subdivided into two branches, [tab. 101] an interior and an exterior, from which diuers propagations are dispersed, as we haue before touched in the eight Chapter of the third booke.

From thence it beginneth to be called *Cruralis* or the veine of the Leg, [table 10 g.] and after the externall braunch [p] hath attained with two boughes vnto the bone of the Leg, it passeth the share-bone [•] and sendeth a circle vnto the *Cup* of the Hippe to be diffused into the muscles of that place which compasse the inside of the Thigh, and so a branch of it runneth vnder the skinne of the Thigh on the same side. Presently after it is ioyned [x] with the internall *Crural* branch [char. 2] and so ceaseth. But because in that place toward the lower part of the Thigh, there is a cavity wherein the branch of the hollowed veine was to be diuided into many propagations, that those propagations might be more firmly secured, there are many Glandules disposed round about, which also are a defence to the Nerue and the Artery that descend that way with the Veine.

From the *Crural* branch [table 10 G] which is the trunk of all the rest of the Veines that run into the Leg, and issueth from the outward branch [table 10 C] of the trunk of the Hollow Veine, there issue on either side fixe branches.

Division of the crural veine into fixe branches.
1 *Saphena*.

The first is called *Saphena* or the branch of the Ankle [⊙] which is a notable and very long Veine. It runneth together with a Nerue fastned vnto it through the inside of the leg, betwixt the skin and the panicle vnto the knee and so on toward the inward ankle, and is diuersly diuided into the top of the foot toward the Toes, especially toward the great Toe where it is mingled with other Surcles sent from other Veines into that place.

From this branch commonly there are foure propagations sprinkled through the skinne. The first is double, one interior [^] which being yet in the groyne sendeth on either side branches to the inside of the Thigh, to the groyne it selfe, and to the rimme of the belly. The other exterior [z] and larger then the former, determining into surcles which are sent into the foreside and outside of the Thigh.

4 Propagations.

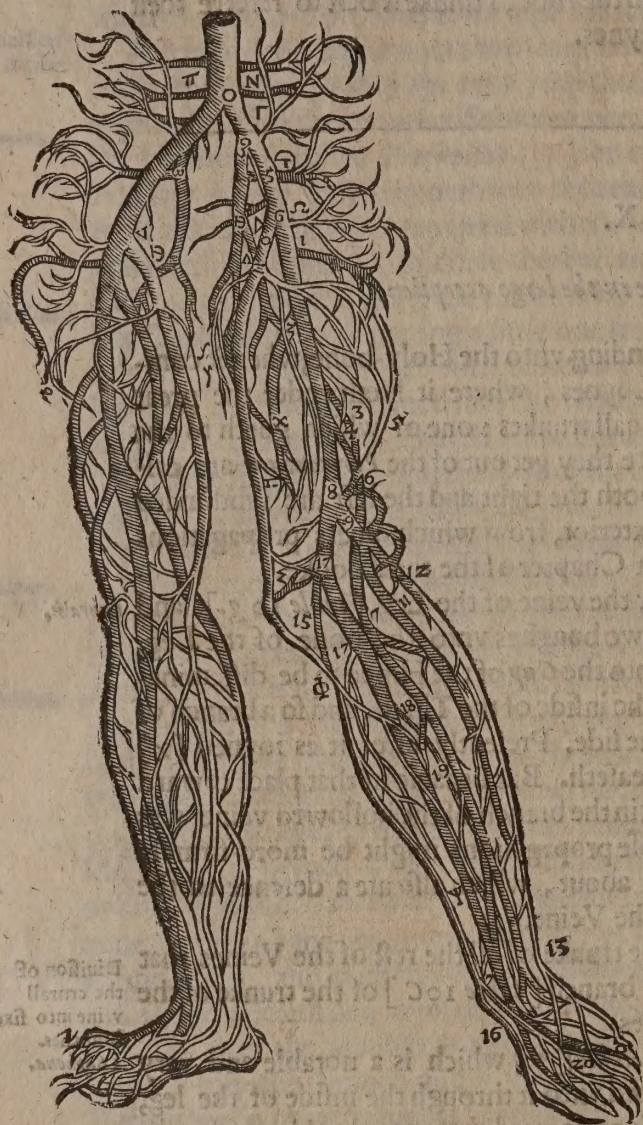
The second propagation at the middle of the legge [11] reacheth to the muscle of the *Tibia*.

The third is rowled orbicularly backward at the knee, and one part of it goeth to the skinne of the whirle-bone, [z] the other into the Hamme: and this branch is altogether wanting when the veine of the Hamme is a little larger then ordinary [Char. 6.] or if it be not wanting it is exceeding small and slender.

The fourth departeth with surcles forward and backward at the middest of the *Tibia*, [tab. 10. from 9 to 10] which circles doe diuersly vnite themselues with the veines that are next vnto them, and are againe parted asunder. Sometimes from the inner part of the *Tibia* vnder the foreside of the Ankle, it is reflected and runneth vnto the vpper side of the foot [v] and is distributed almost into all the Toes of the foote; but the surcles about the foote and at the Toes doe differ much. For in some bodies it is mixed with other branches, and runneth out vnto the little finger: sometimes it runneth towards the Thumbe and the forefinger; wherefore scarce any man hath the same distribution of the Veines

Table 10. Sheweth the distribution of the hollow veyne into both the feet.

TABVLA X.



1 *Muscula*, the vter and lesser branch hereof runneth vnto the 2 and 4 muscles of the leg. 2, the inner and greater branch of the *Muscula* distributed through the muscles of the thigh, especially the first and the third of the leg. 3, 4, 5, Two crurall branches 3, 4, meeting together; furcles passe at 5 backward to the skinne of the thigh, and descend through the middle of the Hamme. 6 *Poplitea*, the hamme-veyne, which veyne the Ancients did often open. 7 Small branches from the hamme-veyne which runne through the skinne of the Calf vnto the heele. 8 *Suralis* or the Calf-veyne. It is diuided at the lower side of the thigh into an exterior trunk, 9, and an interior, 14, 9, 10, The vter branch of the surall veyne at 9, distributing a small branch outward into the skinne of the knee. 11, the diuision of the externall surall branch vnder the knee into an inner branch 11 going betwixt the muscles of the foot. 12, 13, And an vter which runneth through the outside of the leg vnto the outward ankle and the vpper part of the foot in diuers furcles. 14, 15, 16, the inner surall branch 14 runneth through the backside of the leg, a branch of the same through the inside of the leg at 15, which descendeth to the heele and the great toe at 16. 17, 18, *Ischias maior* issuing from the inner branch of the small veyne at 14, and passing vnto the muscles of the Calf. From this a great branch 18 is distributed into the vpper side of the foot and the toes passing downward betwixt the muscles of the leg. 19, The remainder of the inner trunk, 14 which runneth behind the inner ankle, and is consumed into the toes. 20, The coniunction of the externall surall branch with the branches of the *Poplitea* or the hamme veyne.

Veynes in both his feet, the same number and the same magnitude.

This veyne Physicians vse to diuide in the diseases of the wombe, especially in the retenti-
on of the courses, about the ankle.

The second branch of the Crurall veyne is called *Ischias minor* [tab. 10. α] and is opposite
to the former, for as that is the inner branch of the Crurall trunk, so is this the exterior.

α , The diuision of the hollow veyne at the fourth
spondell of the loynes about the holy-bone into
two Iliacke trunks, which diuision is like the
greeke letter Δ .

β , *Muscula superior* disseminated through the mus-
cles of the loynes, of the *Abdomen* and the *Perito-
neum* or Rim of the belly.

γ , the byfurcation of the first Iliacke trunk into an
exterior branch at σ , and an interior at ρ .

τ , *Muscula media*, a propagation of the branch ρ in-
to the outward muscles of the thighs and the skin
of the Buttocks.

χ , the meeting of the branch ρ with the veyne of
the second branch.

ψ , the passage of the branch ρ through the hole of the
share-bone.

ϕ , the Crurall veyne which is the stocke of the veynes
that goe into the leg.

Γ , *Epigastica*, a propagation of the branch σ carried
vpward to the muscles of the *Abdomen*.

$\Delta\Delta$, *Pudenda*, A propagation of the branch σ , which
runneth ouerthwart to the Genitals.

Θ , the veyne of the Ankle called *Saphena*.

Λ , the interior branch of the *Saphena* going to the
inside of the thigh, to the groynes and the *Perito-
neum*.

Ξ , the vter and greater branch of the *Saphena*,
going into the fore-side and outside of the
thigh.

Π , the second branch of the *Saphena* to the first
muscle of the leg.

Σ , the third branch of the *Saphena* rowled orbicular-
ly to the backside of the knee.

Φ , the fourth branch of the *Saphena* which runneth
vnder the skinne through the inside of the leg, and
is distributed into diuers furcles. And this branch
may here be opened.

Ψ , this branch should haue gone downe as farre as
char. 7.

Ω , *Ischias minor*, A propagation of the exterior
branch σ vnto the muscles that sit vpon the
ioynt of the hippe and to the skinne of that
place.

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It is but a short veyne and is disseminated outward and ouerthwart into the fore-skinne of the ioynt of the hip and to the muscles of that place.

Afterward the trunk it selfe passing from the groyne is drenched among the muscles which compasse the bone of the thighs and shooreth out of it selfe the third veyne.

The third veyne is called *Muscula*, [Table 10, char. 1] and is double, sometimes they are swere one another. The viter and lesser of these [char. 1] parteth with surcles to the second and fourth extending muscles of the *Tibia* and into the skin. The inner and the greater [char. 2,] which also lyeth deeper, is diuicuated or diuersified through all the muscles almost of the thigh, especially the fift and the third extender of the legge, and at length assumeth the end of that veyne [et] which runneth through the hole of the shate bone into the thigh, wherewith being increased (but lurking still betwixt the muscles) it descendeth vnto the knee. But the greatest veyne called *Cruralis* [G] in the middle of the thigh, is by degrees writen backward and offers small surcles to the membranes of the nerues that descend vnto the leg. Afterward it parteth with the fourth veyne.

The fourth veyne is called *Poplitea* or the Hamme-veine, which is made of two crural branches vnited. [char. 3, 4] From this in his originall, certaine surcles are sent backward and vpward into the skin of the thigh, [char. 5] afterward it falleth directly vnder the skin through the middest of the bent of the hamme [char. 6] as farre as to the heele. [char. 7, the lower] Sometimes it descendeth to the skin of the outward ankle, sometimes also of the inner, from which in his progresse he sprinkleth many small branches vnto the skin of the Calfe, some right, some oblique and some transuerse vnequally commixed and vnited together. Sometimes we meete with it simple and single, and sometimes this *hamme-veine* [char. 3] assumeth vnto it selfe a branch from the veyne which is sent to the fift muscle of the thigh, [char. 2] and being ioyned therewith it runneth out into the skin on the backside of the thigh, and sendeth some surcles vpward. And this is the veyne which the Ancients vsed to open vnder the knee. The fift veyne of the Crural branch is called *Suralis* or the Calfe-veine. The great veyne of the legge at the lower end of the thigh, after it hath sent small branches backward on either side, [at char. 8] into the originall of the three muscles which make the Calfe, it is in the hamme diuided into an exterior and an interior trunk. The exterior [character 9] after it hath distributed a branch [character 10] obliquely outward toward the connexion of the *Brace* with the *Leg-bone* into the skin on the fore-side of the knee, is presently vnder the knee diuided into two branches; an interior [character 11] which descendeth with the *Brace* among the muscles of the foote, and it endeth where their fleshy part determineth, for it attaineth not to the skin: and an exterior, [character 12, 13] which running along the outside of the legge to the outward ankle and the vpper part of the foot, attaineth to the skinne, but the skin on the outside onely.

It distributeth also (as did the *Poplitea*) [char. 7] diuers surcles, and mingling it selfe [char. 20] with the surcles of the *Poplitea*, especially in the top of the foote which they call the *Backe*, it maketh that knarle of veynes which is seene in the vpper part of the foote vnder the skinne.

The Interior [character 14] descending directly through the backside of the legge looseth a branch [character 15] from his inside, which passing along by the inside of the *Tibia*, is disseminated vnder the skin vnto the inside of the heele and the great toe [char. 16] and is vnited to the surcles that are there-about, and afterward againe diuided from them as we haue said before that other veines do.

And this surely is the reason why in this part so often there are *Varices*, that is, bursten or boddene veynes. But this vnion and diuision or distraction afterward of the veynes was necessary, least when the skinne is offended and some veyne cut ouerthwart, the skin that bordereth vpon it should be destituted of nourishment. Wherefore because in the legge in three or foure places the internall veynes are vnited with the cutany veynes or veyne of the skinne (especially in the foot) if you purpose to open one of them that lye next vnder the skinne there is no reason you should be very scrupulous in your choice, as if they were peculiar veynes deriued from diuers parts or bowels of the body, for they are all propagated from one and the same trunk.

The Interior trunk [char. 14] when it hath sent forth the fore-said branch, [char. 15] runneth deepe and produceth the sixt veyne.

The sixt and last veyne is called *Ischias maior*, [char. 17] the greatest part wherof descending through the Muscles of the Calfe casteth on each side small surcles, and when it attaineth

neth to the separation of the bone of the leg from the Brace-bone, it sheweth out a great propagation [ch. 18] from his forepart, which having perforated the membranous Ligament runneth among the Muscles which occupy the forepart of the *Tibia*, and in his descent affordeth furcles to the neighbour muscles; and when it is past vnder the transverse ligament is distributed in the vpper part of the foot, but so, as it is divided into his Musculous substance, and so giueth to each toe two small branches. And this veine in the Sciatica & other affections of the Hip is vsually opened about the outward ankle; and *Falopius* giueth vs his word, that it is of great auaille though he rely more vpon experience then vpon any great reason.

A note for the
Sciatica.

That which remaineth of the interior branch [chap. 14] runneth into the backside of the foresaid muscles and so attaineth to the sole of the foote, where it is consumed into many small branches which run by courses. Two of them creepe along the inside of each toe, sometimes the little toe hath five, the next to it two, the middle toe one.

And thus haue we brought to an end the History of the veines throughout the whole body. Now we should passe on vnto the Arteries, saying that we promised in the end of the last chapter to say somewhat of the values which are found in the veines, which promise I will now acquit my selfe of.

CHAP. XI.

Of the Values or Flood gates of the Veines.

Anicen.

Aquapendens.

Salomon Al-
bertus.

These Values *Anicen* the *Arabian* seemeth to haue made the first mention, calling them *Cels in the Veines*. *Hieronymus Fabricius ab Aquapendente* an excellent Anatomist of *Padua* in *Italy* made publike demonstration of them in the yeare of Grace 1574. and wrote a Treatise of them in the yeare 1603. *Salomon* also *Albertus* shewed them in the yeare 1579 and wrote of them in the yeare, 1584.

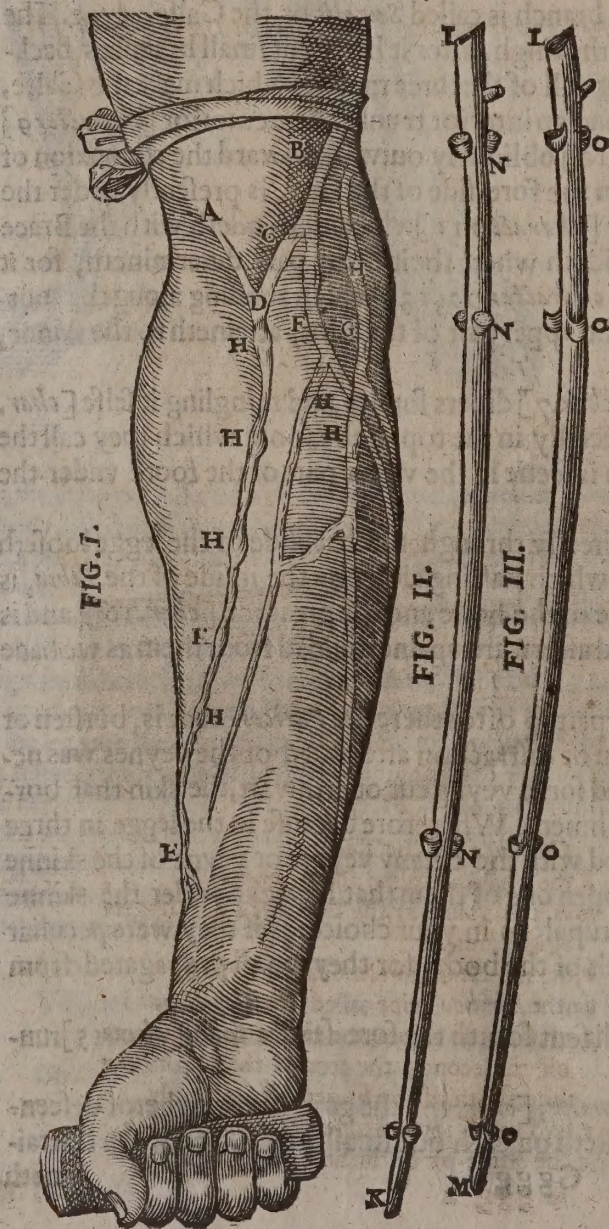


Table xi. Figure 1. sheweth the Arme bound ready for blood-letting.

Fig. 2 and 3, sheweth two Veines of the legs turned the inside outward.

TABVLA XI.

- A, A branch of the *Cephalica* Vein, making the *Median* veine.
- B, C. The *Basilica* B, and a branch of it making the *Median* at C.
- D. The *Median* Veine made of the branches of the *Cephalica* and *Basilica*.
- E. The *Median* Veine being carried through the middest of the *Cubit* diuided about the *Radius*.
- F. A deepe trunk of the *Basilica* or the trunk lying very low.
- G. The trunk of the *Basilica* lying vnder the skin.
- HHH. Values in the veines of the Arme.
- I, K. The first veine of the Leg.
- L, M. The second veine of the leg.
- NNN. The values filled with hum-bast.
- OOO. The values empty.

The Values are of the core of the making in them as so thin as where outside then Valves floodgates which they are seated in the arms-branches which a their nourishment. distributed to other along the large or gated obliquely b They reach fra but vp the ori veine, but are ra been no regurgita in the orifice of th too much backwa The Trunke Artery hath no way distributed as as also for the gen veines are all tog



a. The subclavian b. The orifice of c. The orifice of the d. The orifice of the e. The orifice of the f. The orifice of the g. The orifice of the h. The orifice of the i. The orifice of the j. The orifice of the k. The orifice of the l. The orifice of the m. The orifice of the n. The orifice of the o. The orifice of the p. The orifice of the q. The orifice of the r. The orifice of the s. The orifice of the t. The orifice of the u. The orifice of the v. The orifice of the w. The orifice of the x. The orifice of the y. The orifice of the z. The orifice of the aa. The orifice of the ab. The orifice of the ac. The orifice of the ad. The orifice of the ae. The orifice of the af. The orifice of the ag. The orifice of the ah. The orifice of the ai. The orifice of the aj. The orifice of the ak. The orifice of the al. The orifice of the am. The orifice of the an. The orifice of the ao. The orifice of the ap. The orifice of the aqu. The orifice of the ar. The orifice of the as. 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The orifice of the ck. The orifice of the cl. The orifice of the cm. The orifice of the cn. The orifice of the co. The orifice of the cp. The orifice of the cq. The orifice of the cr. The orifice of the cs. The orifice of the ct. The orifice of the cu. The orifice of the cv. The orifice of the cw. The orifice of the cx. The orifice of the cy. The orifice of the cz. The orifice of the da. The orifice of the db. The orifice of the dc. The orifice of the dd. The orifice of the de. The orifice of the df. The orifice of the dg. The orifice of the dh. The orifice of the di. The orifice of the dj. The orifice of the dk. The orifice of the dl. The orifice of the dm. The orifice of the dn. The orifice of the do. The orifice of the dp. The orifice of the dq. The orifice of the dr. The orifice of the ds. The orifice of the dt. The orifice of the du. The orifice of the dv. The orifice of the dw. The orifice of the dx. The orifice of the dy. The orifice of the dz. The orifice of the ea. 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The orifice of the zp. The orifice of the zq. The orifice of the zr. The orifice of the zs. The orifice of the zt. The orifice of the zu. The orifice of the zv. The orifice of the zw. The orifice of the zx. The orifice of the zy. The orifice of the zz.

The Values are found in the Veynes of the ioynts, and are nothing else but small portions of the coate of the veynes starting in their cavity, and intercepting the one halfe thereof, making in them as it were an angle or corner: wherefore the body of the Veyne is no where so thin as where these small membranes do depart from it. Some men had rather call them *Ostiole* then *Valuula*, which word we do not better know how to English then to call them *Floodgates* which stoppe and intercept the currentsof waters.

What a valve is.

They are seated in the veynes of the arme and the legges above and below after the Glandules of the arme-pits and the groine. Presently vnder the originals or out shootings of the branches which are disseminated from the sides of the veynes into the neightbout parts for their nourishment. And the reason why they were created was, that the blood which is to be distributed to other parts, might in that place make a stay and not be carried in a full streame along the large or direct Canale or pipe, and so the lesser branches, and those that are propagated obliquely be defrauded.

Their situation.

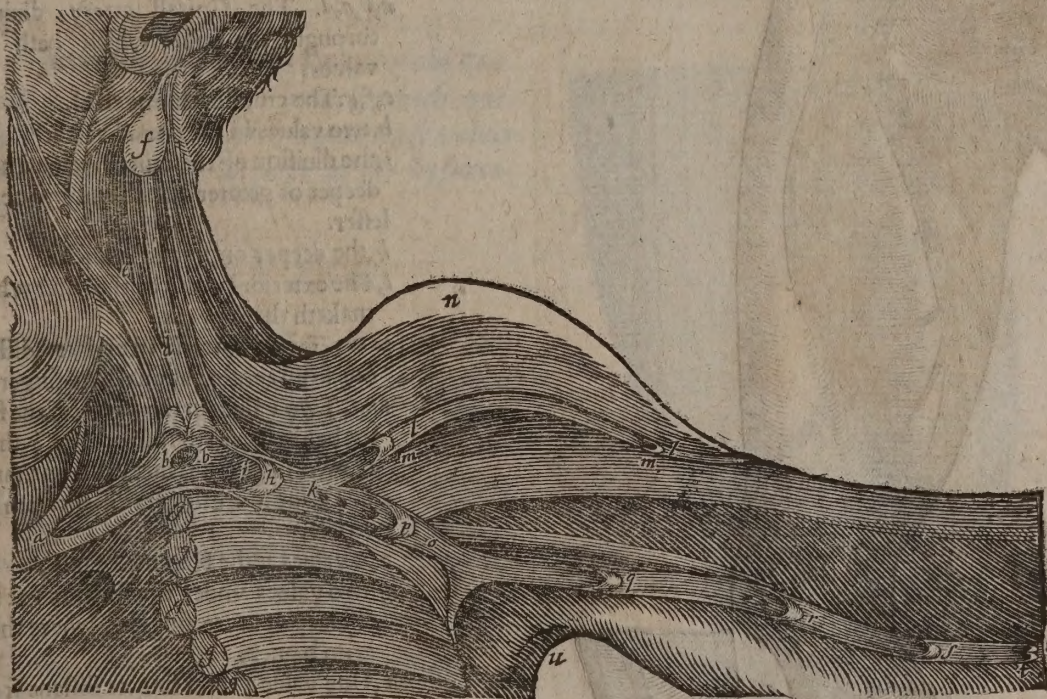
And use.

They reach from the sides of the veines vnto the middle of their capacity: neither do they shut vp the orifices of the branches where they take their beginning out of the hollow veine, but are rather disposed in the branches themselves, for otherwise there could haue been no regurgitation of humors which is very necessary as we are taught by revulsions. But in the orifice of the Iugular veine there are found two Values, least when the head is reclined too much backward the blood should violently rush into the braine.

Where they are found.

The Trunke of the Hollow-veyne in the lower and middle Region, as also that of the Artery hath no Values, that without any obstacle or opposition the blood might be every way distributed as well for the restauration of the substance that vanisheth or wasteth away, as also for the generation of spirits. In like manner an innumerable number of small external veynes are all together without them.

TABVLA. XII. sheweth the values almost in the middle of the arme at the originall of the Inner Iugular veine.



- a, The subclavian veine.
- bb, The orifice of the veine betwixt the inner Iugular and the Axillary veine.
- c, Two values at the originall of the internall Iugular. d, The internall Iugular opened.
- e, The diuision thereof neere the head.
- f, The Glandule vnder the eare.
- g g g g, five ribs cut off.
- h, Values at the Axillary veine. i, The axillary veine produced from the Subclavian.
- k, The diuision of the axillary veine into the

- Cephalica and the Basilica.
- n, the Cephalica called also *Humeralia*.
- m m, two values in the Cephalica five fingers almost asunder.
- u, the muscle of the arme called *Deltoid*.
- o o, the Basilica veine called also *Hepatica*.
- p q r s, Four values, the first is four fingers off the second, the second three from the third, the third two fingers off the fourth.
- t, two values ioyned together in the Basilica.
- u, the Arme-pit or the hole vnder the arme.
- G g g g 2

The

The number of these Values is vncertaine and the distances betweene them very vnequal, yet commonly they are double or two together, vnlesse it be a little about the Transuerse Ligaments which containe the Tendons of the hands, the feete, the fingers and the toes. Also when a large veyne beginneth to be contracted there most commonly they begin to be fewer till at length they vanish quite away. For where it is fit that more blood should be stopped and stopped longer, there are two Values; where lesse and for a shorter time there one will serue the turne, specially there is but one where a lesse vessell is obliquely produced out of a greater.

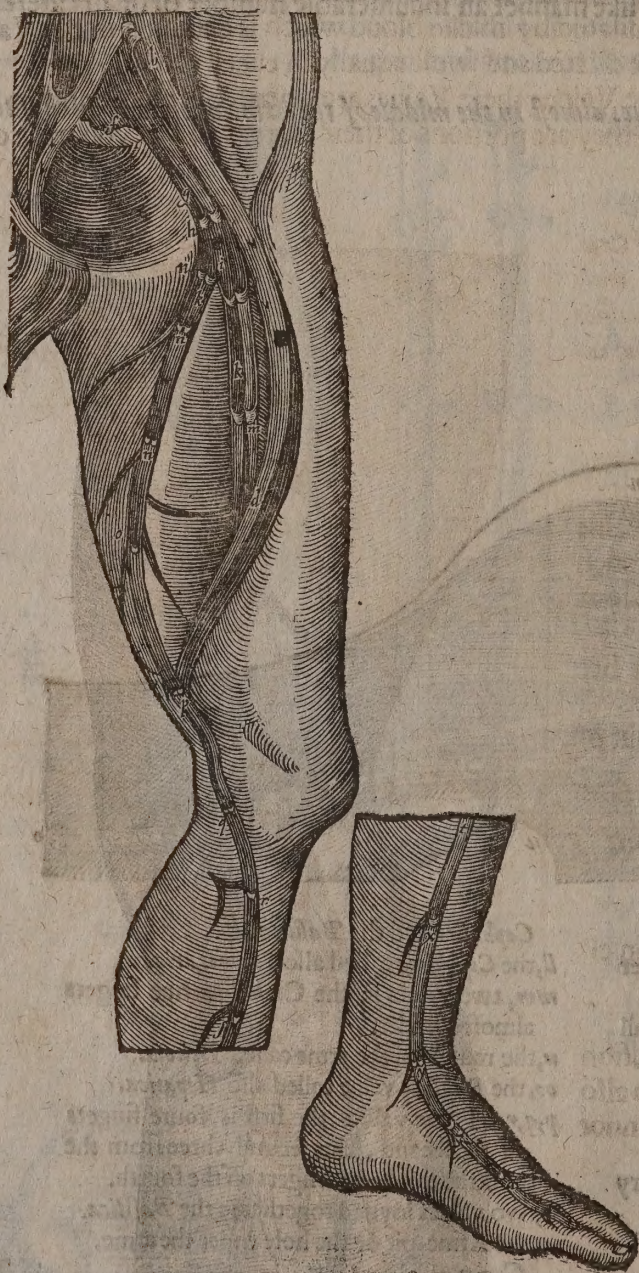
Their distance

In the Cephalica
In the Basilica

For the distance betweene them, although they runne throughout the length of the vessell, yet in some places there is two fingers, in some three, in some foure, in some five fingers distance between them. As for example, in the *Cephalica* vnder the Muscled called *Deltoideus*, there are two Values about five fingers distant one from another. In the *Basilica* as it runneth through the inside of the arme there are foure large Values. The first is foure fingers distant from the second, the second three from the third, the third two from the fourth, after which follow two small Values ioyned together.

In the Veines
of the foot.

So in the foote, (I meane the foote in the large acceptation) in the Hollow-veyne before it be subdivided in the groine there are two great Values set, afterwards when it is diuided into a greater and a lesser trunk, the greater in two places hath two Values foure fingers distant one from another. Thence downward at the Ham one, at the calfe two, then one, and finally two other. But in the lesser trunk there are more, for in the beginning of the byfurcation there are Values; within the distance of two fingers, two more:



TABVLA XIII. sheweth the
crurall veine and Artery, as also
all the lesser branches of the Cruall
veine opened.

a, b, c, d. The Cruall artery diuided
through the midst which hath no
values.

e, f, g. The cruall veine opened.

h, two values in the cruall veine.

i, the diuision of the cruall veine into a
deeper or greater branch and an ytter or
lesser.

k, the deeper or greater branch.

l, The exterior branch or the lesser which
maketh the *Saphena*.

m, m, Two values in two places distant
one from another about foure fingers.

n, n, n, Two values in three places, the first
the beginning of the bifurcation, the 2
at two fingers distance, the 3 at three.

o, one value foure fingers distant from the
two last.

p, 2 values at the Hamme branch.

q, two values vnder the Hamme at the
distance of foure fingers, where there
is no branch.

r, One value, three fingers distant from
the former.

s, One other value foure fingers distant
from that,

t, u. The veine *Saphena*.

x, A value five fingers distant from the
former.

y, two values at the wrist of the foot.

z, a value three fingers distant from the
former.

a, the last value of the *Saphena*, for that
which remaines hath no values at all.

and

and two others three fingers off; likewise in the same veine making the *Saphena* there is one Value; foure fingers off of that two, and vnder the hamme foure fingers off likewise two more; three fingers off there is one, and another foure fingers off it; five fingers off that another, two vnder the wrest of the Foot; three fingers off them one single one, and after the same distance appeareth the last; the remainder of the *Saphena* runs without Values vnto the top of the great Toe.

But because the stronger current and course of the blood might be better abated, these Values are not placed in a right line or alwayes on the same side, for then the whole streame of blood would haue flowed downe that side of the vessell that is free: Wherefore they vary their seat very artificially, as if in the vpper part of the Veine there be two Values, then after the distance which we said was betweene them, other two Values appeare in the lower part of the Veine, so that the hotnesse of the following membranes doe regard the middle and embowed part of those that went before and on the contrary, yet so that in the middest they do not touch one another, but leaue a tract or path whereby the blood may passe downward and fall as well into the lower Values as into these aboue. So then the lower Values stay that blood which escapeth from the vpper, and yet the course of the blood is not yet intercepted.

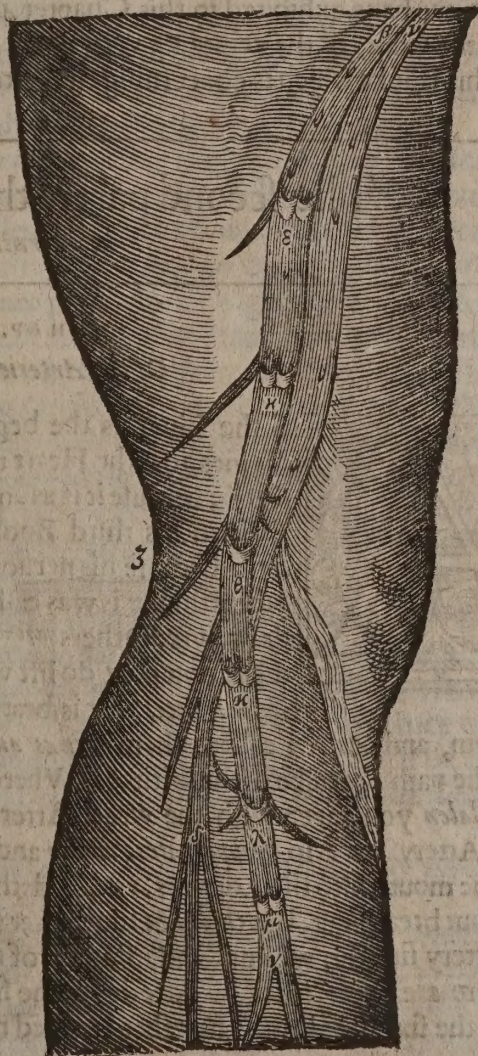
The figure of a Value sayeth *Aquapendens*, is like the nayle of a mans finger, or they be like a horned Moone, on their outside they represent the knots that are in the branches of Plants, for when a mans Arme is tyed to let him blood, there appeare within certaine distances as it were knots on the outside, and in clownish bodies, sayth *Bauhine*, they may be scene to swell in the outside of the Legs like a *Varix* or a veine. And truely a *Varix* is nothing else but a Veine and his Value dilated by thicke blood which is detained in the Value, for without these the veines would be dilated and swell equally in euery place.

Vpward toward the roots of the Veines these Values are open, but below and at the sides they grow to the Veines, for they are portions of their coate. And if you put a quill

Table 14. sheweth the Values of the Crurall veine and his deepe branch which walketh along with the Arterie, and these values may here be scene as farre as the byfurcation.

TABVLA XIII.

- 1, The deeper branch of the Crurall veine which must be tyed with the branch marked with R in the former Table about d, which noteth the Arterie.
- 2, The Crurall Arterie which must be ioyned with d of the former Table.
- 3, Two Values with a propagation out of the Veine.
- 3 The hamme.
- 4, One great Value with a propagation.
- 4, The Calse.
- 5, Two Values without any branch.
- 5, One Value with one propagation on either side.
- 6, Two Values without propagations.
- 7, The Crurall Veines, and the subdivision of his deeper branch into 2, which also haue their Values though they cannot now follow them.



Gggg 3

into

into a veine, and lightly blow, then will the veine swell our like a little bladder, or rather it we may compare little things with great, like the sayle of a shippe when it runneth freshly before the winde.

Their substance.

Their substance is exceeding thinne that they might take vp the lesse roome, yet very thight and fast for more strength that they might not be broken by the violent incurfion of the blood.

Their vse.

Their vse is to stay the blood from falling too hastily into the lower parts, otherwise because the ioynts doe hang downward the blood would haue falne into them like a streame, and so the lower parts should haue bene oppressed by too great an affluence of Aliment, and burdened with a weight of humour, but the vpper parts should haue bene defrauded. Now by reason of these valves the Aliment doth subfist or make stay in the greater vesselles as it were in a founraine, that the smaller veynes might alwayes haue nourishment at hand to conuay vnto their particular parts.

Againe, because the veynes were created not onely to deriue or transport the blood into the parts, but also to adde something vnto the perfection of his concoction, there is no doubt but these values were ordained to stay the course and violence of the blood that the veines might haue time to bestow their trauell vpon it.

Thirdly they adde strength vnto the veines, for were it not for these, it is likely that where a *varix* hapneth, there either the veine would breake, or at least the dilatation be much more offensive. For because the veine is of a membranous, simple and thinne substance, it may easily be stretched or broken.

Fourthly, when we exercise our ioynts vehemently and often, the heat of the parts is stirred vp and the blood partly disturbed partly called into the ioynts, where the values do breake the force of it and so keepe it from mischief.

Finally, if it were not for them in those violent motions of the ioynts, the whole masse almost of blood would be called into the armes and the Legs, and so the principall parts or bowells of the body be defrauded of their allowance, and thus much of the Values. Onely, because, they are not so well known nor so ordinarily demonstrated as the other particles of the body, we haue exhibited in this Chapter 4 tables. Two of the Hand and 2. of the Foote, wherein the values of the veines are very liuely described; and so we proceed vnto the second part of this Booke which is concerning the Arteries.

The second part of the Eleauenth Booke

concerning Arteries.

CHAP. IX.

Of the Arteries in generall.



The names of an Artery.

As the Liuer is the beginning of *Radicacion* and *Dispensation* to the Veines, so is the Heart to the Arteries. This Artery the Grecians call *αορτη*, because it is as an Arke or Conceptacle of arteriall blond. *Aristotle* in his third Booke *de historia animalium* thinketh it was called *aorta*, because his neruous part may be perceiued euen in a dead body; others thinke it was called an Artery, *πρὸς τὸ τὸν ἀέρα τερεῖν*, that is, to draw ayre. Others *πρὸς τὸ ἀρθεῖν*, which signifieth to lift vp, for in their dilatation they do lift vp themselves: *Hippocrates* calls Arteries *αἰμαίνες*, but *micantes*, that is, bearing veynes. In like manner did the Arabians

stile them, and *Auicenna* calleth them *venas audaces*, bold veines. *Pliny* calles them *spiritus semita*, the path or walke of the spirites. Wherefore if in any of the Ancients which wrote before *Galen* you meet with the word Artery simply, then must you vnderstand it of the Rough Artery: for so *Hippocrates*, *Plato* and *Aristotle* did call that pipe which descendeth out of the mouth into the Longues, and leadeth inspirated ayre into them and by which we returne our breath out. But *Galen* & those after him called it *aspera arteria*, and if they speake of an Artery simply, we must vnderstand it of the smooth Arteries.

Three sorts of Arteries.

There are three sorts of Arteries: the first is called the *Rough Artery*, of which wee spake in the sixt Booke. The other is called the *Venall Artery*, of which also wee spake in the

the history of the heart. The third is called the great artery which is the subject of our discourse at this time.

We consider it therefore as it is a Similar and as it is an Organical part. As it is similar it may be defined *A Colde and dry part engendred of the slimy part of the Seede.* Colde it is of his owne nature, but by euent it is most hot in respect of the blood and spirits therein contained. It is dry also: lesse dry then a Tendon, and more dry then a Nerue.

An Arterie as it is similar.

But against this it may be Obiectioned, that *Galen* in his second Booke *ad Glauconem* saith, That *Nervous parts require more drying then Arteriall, and therefore are dryer then they.*

Obiection.

I answer, that by nervous parts in that place he doth not vnderstand nerues properlie so called, but nervous bodies as Ligaments and Tendons.

Solution.

If we consider an Artery as it is an organical part, it may be said to be a common instrument of the body, long, rounde and fistulated, compounded of two peculiar Coates, intertexted or woven with Fibres, receiuing and containing Bloode and Vitall Spirits laboured of a permixtion of Blood and Aire in the left ventricle of the heart, which also conueyeth vnto all the parts of the body, together with heat to sustaine their life.

Defined as Organically.

The substance thereof is membranous or nervous that it might better be distended or compressed, which conformation was more necessary for Arteries then for veins because of their motion.

The substance.

The coats are one outward which is thin rare and soft like the coate of a veine, woven with many right fibres and some oblique, but none transuerse. Another inward finefolded thicker then the former, fast and hard, partly that the arteriall and spirituuous blood (which is thin, pure and vaporuous) and the vitall spirit might not exhale or vanish away, partly that by reason of his continuall *Diastole* and *Systole* which it receiue from the Heart as from a beginning of dispensation it might not be broken. It is also full of transuerse fibres the better to distribute the blood and vitall spirit to the whole body in his action and motion, for the inner coate onely of the arteries hath these transuerse fibres. To these two coats *Galen* addeth a third in the fifth chapter of his seventh Booke, *De administrationibus Anatom.* which some say is produced from the coate of the heart. It is in the inner surface of the vessell much like a Cobweb and most conspicuous about the productions of the greatest arteries.

Coats.

Moreover, they receiue a common and fine membrane in the lower belly from the Rim, in the Chest from the *Pleura* which couereth them, firmeth them, or tyeth them to the neighbour-parts, yet those arteries which run through the bowels haue not this coat.

The great artery is sometime called simply *great*, sometime the *greatest*, sometimes the *thickest* artery, sometime *Aorta*, and is indeed the mother of all the rest of the Arteries, (except the Rough artery and the venall and vmbilical arteries) being like a trunk or body of a tree, out of which all the branches do yssue. It was engendred, saith *Bauhine* out of *Galen de formatione fœtus*, before the Heart was formed and hath one principle of Originall; that is, the seede out of which it is immediately made as being engendred at the same time with other spermatikall parts; Another of Dispensation and Radication which is the heart or the left ventricle thereof, out of which it yssueth with a patent or open Orifice, whereby it receiue from the heart in his contraction Blood and vital spirits together with heate to be transported to the body. But because in the dilatation of the hart this blood and these spirits should not returne againe into the ventricle, there are placed in his orifice three values issuing from within outwarde, as also there are in the arteriall veine. But these of the artery are stronger and greater, because the body of the artery is harder then that of the arteriall veine.

The great Artery.

His originall.

Values.

These values also do hinder the aliment which is drawne by the Meseraicke arteries from the guts, that is the Chylus, which *Hippocrates* in his Booke *De Corde* calls *Alimentum non principale*, as if he should say an aliment at the second hand, lest I say, this Chylus should get into the heart. The Orifice also of this artery is established with a hard substance which is sometimes gristly, in some greater creatures a bony gristle, for it is very rare if it be found a true bone, notwithstanding that *Galen* saith it is a bone in an Elephant, but in man there is no such thing found.

Hippocrates.

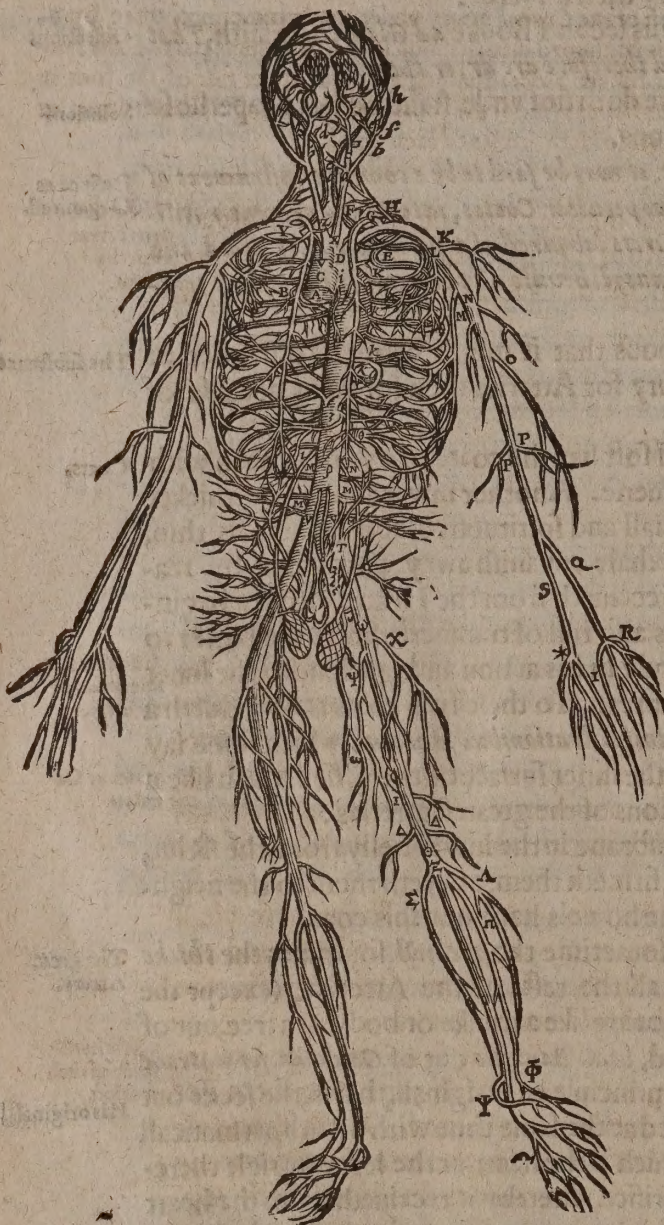
The branches of this great Artery are distributed into the whole body, as may appeare by this Table which we haue heereto annexed.

In this distribution of the branches of the great Artery they accompany the branches of the Gate and the Hollow-veynes, yet are their propagations not so frequent, because the Artery doth not alwayes accompany the veine, for those veynes that goe vnto the skinne haue no arteries with them, at least that are conspicuous. Again they are very rarely dif-

feminated

Table 15. sheweth the great Artery whole, and separated from all the parts of the body, together with his diuisions and subdiuisions.

TABVLA XV.



the little finger, the ring finger, and the middle finger. * A little branch vnto the muscles about the little finger. T. the distribution of the vpper and lower branches into the hand and the fingers. V. the trunk of the great artery ascending to the *Inguinum*, and the diuision thereof in that place into X, Y, Z. X. the left *Carotis* or sleepey artery. Y. *Subclavian dextra* is diuided into branches, as the right is diuided. Z. *Carotis dextra* called also *Apoplectica* and *Lebargica*. a, The diuision of the left *Carotis* in the Chops. b, the exterior branch of that diuision going into the face, the temples, and behinde the ears. c, the inner branch going to the throtle, the choppes and the tongue. d, the diuision hereof at the basis of the skull, into two branches which enter the *sinus* of the *Dura mater*. e, A propagation of the branch b, vnto the muscles of the face. f, the distribution of the branch b, vnder the roote of the ears. g, the fore-branch hereof creeping vp the Temples. h, the backe branch running on the backside of the eare vnder the skinne. i, the trunk of the great artery, descending vnto the spondels of the backe. k k k, The lower *Intercostall* arteries which goe vnto the distances of the eight lower ribbes, from which are offered surcles to the marrow, and to the muscles that grow to the backe and to the Chest. l, the artery of the midriffe called *Phrenica* or *Diaphragmatica*. m, *Mesenterica Superior*, but you must note that about m, the trunk of the *Celiacal* artery is taken away, lest the multitude of Letters in so small a table should breed obscurity. n, b, The right and left emulgents running from the *Aorta* or great artery vnto the Kidneys. n, n, The spermaticall arteries on either side going to the testicles. a, the lower *Mesentericall* artery on the left below m, running especially into the Collicke gut on that side. μ μ, The arteries called *Lumbares* which runne ouerthwart and like knees affording surcles to the muscles that grow to the Loynes, and to the *Peritoneum*. μ, the lower; *Muscula superior* running into the sides of the *Abdomen* and the muscles. ν, The byfurcation of the great artery into two *Iliacke* trunks, and at the sides but somewhat inward are branches which make those that are called *Sacra*. T, the diuision of the left *Iliacke* trunk into an inner branch at ξ and an ytter at φ. ξ, The inner *Iliacke* branch. o, *Muscula inferior*, the ytter propagation of the inner

- A, The orifice of the great Artery, or the beginning thereof, where it issueth out of the heart.
 B, *Coronaria*, so called, because like a crowne it compasseth the basis of the heart.
 C, The diuision of the great artery into 2 trunks V i.
 D, The left subclavian climbing obliquely vpperward vnto the ribs.
 E, the vpper intercostall artery, or a branch which bestoweth foure propagations vnto the distances of the lower ribs.
 F, the necke artery which through the transuerse processes of the rackbones of the necke, attaineth to the skull, bestowing circles vnto the marrow and his neighbour muscles.
 G, the left Mammery artery running vnder the brest-bone, and to the nauell. It distribureth surcles to the *Mediastinum*, the muscles of the brest, and of the *Abdomen*.
 H, *Muscula*, or a branch attaining to the backward muscles of the necke.
 I, The *Scapular* arteries which goe vnto the hollownesse of the blade, and of the muscles that lye thereon.
 K, *Humeralia* which climbeth ouer the top of the shoulder.
 L, *Thoracica superior* sprinkled vnto the forward muscles of the Chest.
 M, *Thoracica inferior*, which passing along the sides of the Chest, attaineth to the broad muscle of the arme.
 N, the axillary artery running out into the arme and affording branches vnto the muscles thereof.
 O, A branch reaching to the outside of the cubit lying deepe.
 PP, Branches to the ioynt of the cubit with the arme.
 Q, the vpper branch of the artery running along the *Radius* and offering surcles to the thumbe, the fore-finger and the middle finger.
 k, A surcle creeping vnto the outside of the hand and led betwixt the first bone of the thumbe and that of the After-wrist supporteth the fore-finger where we vse to feele the pulse.
 S, The lower branch of the artery running along the *Vlna* and communicating surcles to

inner branch going vnto the muscles which couer the branch bone and the *Coxendix*. *π*, *Hipogastrica*, the inner propagation of the inner branch going to the bladder, the yard and the necke of the wombe. *ρ*, The vmbilicall artery. *ς*, The remainder of the branch & assuming an addition from the vtter branch neare *ο*, and so falling through the hole of the share bone into the leg. *τ*, *Epigastrica*, it ascendeth v pward vnto the right muscle of the *Abdomen*, and about the nauell is ioyned with the mammary artery. *υ*, *Pudenda*, it creepeth ouerthwart the share bone. *φ*, The *Crural* trunk without the *Petitonium*. *χ*, *Muscula cruralis exterior*, going into the fore muscles of the thigh. *ψ*, *Muscula cruralis interior*, going vnto the muscles of the inside of the Thigh. *ω*, The coniunction of this artery with the branches. *Γ*, *Poplitea*, going to the muscles on the backside of the thigh. *ΔΔ*, which communicateth small branches to the ioynt of the knee, and the muscles that make the Calf of the Leg. *Θ*, the diuision of the *Crural* artery vnder the hamme into three branches. *Α*, *Tibia exterior*, it accompanieth the *Brace* bone, and is consumed into the muscles. *Β*, the chiefe part of the *crural* artery. *Ξ*, the vpper and backer *Tibia*. *Π*, the lower and backer *Tibia* running vnto the vpper side of the foot at *Φ*. *Ψ*, A propagation of the *crural* artery going to the inner and vppet side of the foote and sprinkling a branch vnto the ankle. *Ω*, A propagation vnto the lower part of the foot which affordeth surcles to each Toe.

diffeminated into the muscles, but creepe onely on their outides, because the thinne blood of the arteries, and their subtile spirits when they issue from them, are able to insinuate themselves farre into the substance of the part without the helpe of a vessell.

The arteries why fewer then the veins.

CHAP. XIII.

Of the use of Arteries.

THe use of the great Artery and of his branches may be considered two wayes; either as they are Canales or Pipes, or as they moue and beat perpetually. As they are Canales or Pipes, they haue three vses or ends. First to containe spirittuous and vitall blood, and to distribute it vnto the whole body, partly for the perfect nourishment of the particular parts, for the parts (saith *Galen* in the tenth Chapter of his sixt Booke, *De usu partium*) which are neare vnto the Arteries doe draw out of them vaporous blood though it be but little, partly for the nourishment and generation of the animall spirits.

A double consideration of their vse.

3. vses as Canales

The second vse is to leade vnto the parts vitall spirits, to cherish and sustaine those vitall spirits which are seated in the parts. Thirdly, with the same spirit to transmit heate and the vitall faculty perpetually into the whole body, to cherish the in-bred heate of the particular parts, to moderate and gouerne their vitall functions and to defend their life.

As the Arteries doe beate, so haue they also a treble vse. The first is to preferue the in-bred heate of all the members which they doe by ventilation or wafting aire vnto them. For if it were not breathed, it would by degrees languish and be extinguished. Their second vse is by their motion to make a kind of commotion in the blood (for the arteries accompany the veins) which if it were at rest would putrifie like standing waters, for blood, saith *Hippocrates*, is water. The third is to sollicite and to constrain the blood to fall out of the Veines into the substance of the parts for more speedy nourishment.

3. vses in respect of their motion.

This motion of the Arteries is called *pulsus* or pulsation (of the word *Hippocrates*, as *Galen* witnesseth, was the first Author) which is absolutely absolued by dilatation and contraction: qualities not bred with the artery or seated in their substance, but flowing into them from the heart, which may be demonstrated if you intercept a part of an artery with a tye, for the part that is vnder the tye will haue no motion, but as soone as the tye is taken away, the motion will returne.

Pulsation

Erasistratus conceiued that the Arteries moued quite contrary vnto the motion of the heart: but we agree rather with *Herophilus*, *Aristotle*, and *Galen*, who thinke they are dilated and constringed in the *Diastole* and *Systole* of the heart: onely wee must remember, that the motion of the heart is swifter and more vehement then that of the Arteries, which you may thus make experience of. Lay your right hand vpon your heart, and with your left hand touch the wrest of your right hand, and then you shall perceiue whether the motion of both be the same or contrary, but the more certaine knowledge of this point is taken from the dissection of liuing creatures.

In the contraction of the Arteries they strongly drive vitall spirits into the whole body

dy

dy and expell by expreffion foety and smokie excrements arifing from the humours which otherwise would fuffocate the heate. When they are dilated they snatch from the heart fpirits as a new matter which in their contraction they communicate to the particular parts to be a vehicle of the heat, and do affume out of the neighbour veynes naturall blood for their proper nourifhment by the inoculations which are betwixt them and the veynes, and that is the reason efpecially why the veines & the arteries do walke together throughout the whole body vnleffe fome great obftacle be in the way. But the arteries lye vnder the veynes vnleffe it be at the holy-bone, not fo much for defence as becaufe by their motion they might conftaine the veynes to powre out their blood, as alfo to make a confpiration or confent betwixt the veffels, and a communion of their matters that the arteries might afford vnto the veynes fpirit and life, and the veynes vnto the Arteries naturall blood.

Why they lye
vnder the
veynes.

Againe, by this vicinity of the veffels the membranes which couer the veines and tie them vnto the parts by which they paffe, are alfo of great vfe vnto the Arteries.

It is alfo thought that thefe Arteries by the pores of the skin do draw Aire whereby the heate which is within is breathed, which breathing is called Transpiration. But concerning the motions of the Arteries and by what faculty they are moued, whether they moue as the heart moueth, or contrary vnto it, we haue intreated in the fecond, third, fourth, and fifth Questions of the Controuerfies of the fift booke, to which places we referre the Reader.

CHAP. XIII.

Of the ascending Trunke of the great Artery.

The great
Artery.



THE great artery at the left ventricle of the heart from whence it arifeth, is exceeding large, whence Hippocrates, Plato, Aristotle, and Galen haue all agreed that the heart is the fountaine and originall of Arteries [Table 16 fig. 1 A] and before it fall out of the Pericardium or purfe of the heart about the valves, [Table 16 fig. 3 char.

The coronary
Arteries.

1, 2, 3] it affordeth fometimes one fometimes two coronary arteries, [Table 16 fig. 1 BB] which like a Crowne do compaffe the Basis of the heart, and through the length thereof together with the veyne difmiffeth branches which are more and larger in the left fide, and thofe make the fubftance of the heart viuide or liuely. Prefently after, a little vnder the trunk of the Arteriall veyne, it arifeth vpward and pierceth through the Pericardium, and is diuided into two vnequall parts, one of which ascendeth vpward [Table 16 fig. 1 E] vnto the head which is the leffer, the other and the greater by much runneth downward [Table 16 fig. 1 D] becaufe the parts of the creature which are vnder the heart are more a great many and greater then thofe that are aboue it. This trunk is proportionably answerable to the flock or body of a tree, and inclineth vnto the fift rackbone of the cheft, & declining a little to the left hand to giue a way vnto the hollow veyne, it descendeth vpon the rack-bones vndiuided, which part Aristotle properly called *Aorta*, becaufe euen in dead bodies the neruous part thereof was confpicuous, haply becaufe it is like to a Macedonian fheath which is called *κορτη*. *Praxagoras* vfed to call it *Craffa* or the thicke Artery. From this trunk, branches are difperfed which accompany the branches of the gate and hollow veynes into the whole body.

The greater
Trunke.

From the greater trunk therefore [Table 16 fig. 1, D] which in the cheft is largeft and thickeft, do iffue thefe branches following.

Intercostales
inferiores.

The lower intercoftall Arteries [Table 16 fig. 1, HHH] which proceeding in order from his hinder fide, are fent on either hand to the diftances of the eight lower ribs, as far as to their griftles: and thefe againe do diftribute furdles to the mufcles which grow vnto the back and cheft, and to the fpinall marrow through the holes which are made in the rack-bones for the out-lets of the nerues, after the fame manner that the veyne *Azygos* diftributeth his branches: for it is very rare to find the veyne *Azygos* accompanied with an artery iffuing from the *Aorta*, and then it may well be called *Intercostalis maior*, or the great intercoftall artery.

Phrenica.

Secondly iffue the artery called *Phrenica* on either fide one, [Table 16 fig. 1, KK] which is diffeminated through the midriff, and from thefe are fmall branches fprinkled alfo to the Pericardium where it groweth to the midriff. Sometime this *Phrenica* arifeth from the trunk vnder the midriff. The reft of the trunk that remaineth paffeth through the fiffure of the midriff [Table 15 fig. 1, *] cleauing to the bodies of the rack-bones, & from it are many propagations diftributed throughout the lower belly, of which we fhall fpeake in the next chap. and in the 16.

From

From the lesser and ascending trunk [table 16 fig. 1 E] which amongst the separating membranes lieth vnder the hollow veine and resteth vpon the rough artery, are branches communicated to all the parts about the heart.

First of all it sendeth on either side a notable branch which vnder the collar bone attaineth vnto the first rib of his owne side, and therefore it is called the *Subclavian* artery. Afterward the whole trunk departeth into the two sleepey arteries.

The right *Subclavian* artery [table 16 fig. 1 F, whose originall is at a] issueth out of the *Aorta* where it is diuided into the sleepey arteries: and this is the higher and larger branch, and runneth more ouerthwart then the left which ariseth much lower where the *Aorta* is retorted downward and attaineth more obliquely vnto the arme.

The right
subclavian
artery.

From either *Subclavian* before it fall out of the cavity of the Chest (for when it is out of the Chest it is no more called *Subclavian* but *Axillaris*) [table 16 fig. 1 PP] as soone as it toucheth the first rib and not before, are propagations deriued from the lower part; first.

Table 16, is the same with Table 13.

The vpper intercostall [table 16 fig. 1 II] which being fastned to the roots of the ribs communicateth particular branches to three or foure distances of the vpper ribs on his owne side; (but not alwaies after the same manner) from which surcles are distributed to the marrow of the backe and to the Neighbour-muscles. From the vpper part doe issue.

Intercostalis
superior.

First the *Mammaria* or the Artery of the paps [table 16 fig. 1 LL] which being reflected vnder the brest-bone descendeth accompanied with a Veine vnto the papes and the muscles [table 16 fig. 1 CCC] which occupy the distances of the gristles of the true ribs. It sprinkleth also surcles into the Glandules and the parting or diuiding membranes vnto which it adhereth, and at the side of the gristle called the brest-blade issueth out of the Chest and runneth vnder the right muscles of the *Abdomen* dispersing his fauors into the sides. At the Nauell it is diuided into many surcles, [table 16 fig. 1 dd] and is ioyned with the Epigastricke Artery which plyeth vpward. [table 16 fig. 1 ee.]

Mammaria.

The next artery which ariseth from the vpper part of the *Subclavian* trunk is called *Cervicalis* or the artery of the necke. [table 16 fig. 1 MM] It issueth more backward toward the bodies of the racke bones, sometimes from the sleepey artery, and ascending vpward when it hath attained vnto the seuenth rack-bone of the necke, it passeth through the holes in the transuerse processe of the said rack-bones, for which cause also Nature made them perforated; and distributeth his surcles to the muscles, the marrow of the necke, & to the Rack-bones. These surcles go in where the nerues get out. There is also an artery which perforating the membrane of the marrow betwixt the first racke and the Nowle-bone [table 16 f. 1 NN] entereth on both sides into the scull, ioyneth with his opposite and runneth along the basis of the Braine.

Cervicalis.

The third is called *Muscula* [table 16 fig. 1 OO] It sendeth branches vnto the Muscles which lye vpon the necke as farre as the nowle: sometimes also to the Muscles of the Arme.

Muscula.

After this trunk hath gotten out of the cavity of the Chest, we said before that it getteth a new name and is called *Axillaris*. From the axillary Artery therefore [table 16 fig. 1 PP] before it attaine vnto the arme there issue three Arteries.

Axillaris arteria.

The first is called *Thoracica superior* [table 16 fig. 1 QQ] which runneth on either side with abundant surcles vnto the Muscles which lye vpon the brest, and next vnto these are those small shootes which are allowed to the little glandules vnder the Arme-pits.

Thoracica
superior.

The second is called *Thoracica inferior* [table 16 f. 1 RR] which runneth downward all along the side of the chest, especially into that muscle which is called *Latissimus* or the Broad muscle.

Thoracica
inferior.

The third is called *Scapularis* [Tab. 16 fig. 1 S] which is disseminated into the Muscles reposed in the hollow side of the shoulder-blade. From the vpper part of the Axillary branch ariseth an artery called *Humeraria* [tab. 16 fig. 1 TT] which climbeth to the top of the shoulder, and is distributed to the Muscles which occupy the arme and the gibbous side of the blade. That which remaineth of the axillary artery [tab. 16. fig. 1 VV] runneth away vnto the arme being accompanied with the axillary veine whose diuisions we shall finde in the 19 chapter.

Scapularis.

Humeraria.

The remainder of the ascending trunk [tab. 16 fig. 1 E] resting it selfe vpon the rough artery toward the vpper part of the brest-bone being yet in the cavity of the chest is supported with the *Thymus*, and diuided into two vnequall branches which they call *Carotides*

[ta. 16.

[table 16 fig. 1 X T] or *Soporaes* the sleepey Arteries. These tend directly vpward, so that the right as also the left run through the sides of the necke vnto the basis of the scull being tied to the rough Artery and the internall Iugular veynes with a membrane, (for the Externall Iugulars are without arteries) and so reach vnto the head where we shall finde them in the 17 chapter.

CHAP. XV.

Of the descending trunk of the great Artery accompanying the Hollow Veine.



7 branches before the diuision.

THE Trunke of the great Artery [Table 17 L] at the eleuenth racke-bone of the Chest passing through the Midriffe [Table 17 char. 4.] runneth through the lower belly leaning vpon the left side of the bodies of the racks, and lying vnder the left side [table 17 L] of the hollow veyne [Table 17 K] declining somewhat to giue roome thereunto, and before it come to the last Racke saue one of the Loines, in some bodies at the Holy-bone [table 17 char. 14] where it is diuided into two trunks, it affoordeth seuen branches, whereof some do accompany the branches of the Gate-veine, as that called *Celiaca* and the double Mesentericall branch which depart vnto the Stomacke, the Mesentery and the Guts, of which we shall speake particularly in the next chapter.

Others accompany the branches of the Hollow-veyne couered with the *Peritoneum* or Rim of the belly, of which we shall intreat in this chapter. For Nature almost alwayes diuideth the Arteries where she diuideth the Veines, partly that the membranes wherewith she couereth the Veines and fastneth them to the neighbour parts might be of vse likewise vnto the Arteries, partly also that there might be a conspiracy between the vessels and a communion of matters, for there are few Veines without arteries ioyned vnto them vnlesse it be those that run immediately vnder the skin. Now the order of the branches as they arise out of the trunk is on this manner.

The first is called *Celiaca* [table 17 char. 6.]

Celiaca.
Mesenterica
superior.
Emulgens.

The second *Mesenterica superior*. [Table 17 char. 10]

The third *Emulgens* or *Renalis*, the artery of the Kidneyes [Table 17 d e] one left and another Right, sometimes but rarely we finde three or foure or more. This is a notable branch and well nie the greatest of all that arise from out of the great artery. It issueth out of either side of the trunk where the first and second rack-bone of the Loins are coupled with a Ligament, and pacing obliquely at the cavity of the Kidneyes it is diuided as the Veines are, and so implanted therein and therein consumed, imitating for the most part the distribution of the Veines.

Their vse.

Their vse is not so much to leade vitall blood as to purge away the whey from the vitall blood of which there is abundance in the great artery. Notwithstanding the fat membranes of the Kidneyes though they be neere at hand, doe not scarse at all partake of these arteries.

Spermatica.

The fourth is called *Spermatica*, the seede artery. [Table 17 char. 11] Both of them issue together (for their originals do touch) out of the forepart of the trunk, and descending the right rideth over the trunk of the hollow veine, and is fastned vnto the spermatieall veyne of his owne side (as the left is to the left) by the mediation of the *Peritoneum*. Afterward in men they passe the productions of the same *Peritoneum* and are applyed with a winding passage to the Testicles, whereto as also to their coats they affoord furcles. The vse of which application is to leade vnto them venall and arteriall bloode and vitall spirits. But in women the one halfe goeth to the Testicles, the other vnto the body of the wombe. And from these *Columbus* thought the vmbilicall arteries had their originall, but what reason he had for his conceite there I leaue him.

The fift is called *Mesenterica inferior*. [Table 17 char. 12]

Mesenterica
inferior.
Lumbaris.

Table xvij. is the same with the eight of the third Booke.

The sixt is called *Lumbaris*. [Table 17 the upper mmm] These are two arising out of the backside of the Trunke where it ioyneth to the rackbones & run crookedly through the holes of the racks of the Loynes and are distributed vnto the spinall marrow, as also to the Neighbour-muscles and to the *Peritoneum*. These also at the sides of the marrow together with the veines run vpward to the braine. *Columbus* maketh mention of no more branches before the diuision of the great artery, but *Laurentius* whom *Baubine* also followeth addeth a seuenth.

The

CHAP. 15. The descending trunk accompanying the hollow Veine.

The seventh therefore is called *Muscula superior* [tab. 27 the lower mm] which also is referred to the *Lumbares*, but larger then the rest and runneth out vnto the sides of the *Abdomen*, and blesteth his muscles with abundant furcles,

After these branches are distributed, the greater artery at the beginning of the Holy-bone [tab. 17, char. 14] climeth ouer the hollow veine, not as challenging the superiority, but because being perpetually moued it might haue beene offended if it had beaten against the bare bone.

At this place by reason of the parts through which it passeth it is called *Iliaca*, [tab. 17, r] and as the hollow veine so is it deuided aboue the body of the fourth Racke of the Loynes into two trunks after the manner of λ inuerted or turned vpside downe. Vnder this bifurcation yssueth the artery called *Sacra* [tab. 17, 00] whose furcles runne through the holes of the holy bone vnto his marrow. Not far from the deuision each trunk [tab. 17, p] is deuided into an interior or slender branch [tab. 17, s] and an exterior or greater [tab. 17, 5] which falleth vnto the Leg. From the interior branch yssue two propagations, one vter the other inner.

The vter is called *Muscula inferior* [tab. 17, ss] and runneth transuersly [table 17, f] outward betwixt the holy-bone and the bone of the hip, and is distributed with many furcles into the muscles which couer the haunch-bones and the hippe-oynt. In like manner at the groyne from one of the trunks ariseth a notable branch which runneth vnto the skin and cheriseth the *Cutany* parts which appertaine vnto the share, to the hanches and to the *abdomen*.

The inner is called *Hypogastrica* [table 17, u] which is the largest of all the rest, and runneth directly downward to the lower part of the *Os sacrum*, to the bladder and his necke, (some say also to the fundament, and may there be called the *Hemeroidall* arteries) and finally to the muscles which couer the share-bone, into all which parts his furcles are distributed.

In women this *Hypogastrica* is yet larger, and is distributed abundantly into the bottome of the womb. It sprinkleth also the neck thereof and the bladder with smal furcles. It sendeth forth also a branch which vnder the bifurcated originall of the yard runneth strangely intangled to his two hollow bodies, so making a kinde of web or complication and passeth vnto the nut. The remainder of the interior branch [table 17, p] creepeth downward, and admitteth vnto it the vmbilicall artery [table 17, at x] which passeth throughout the length of the great artery, and at the sides of the bladder for more strength is tyed with strong membranes, by which vmbilicall artery the Infant in the wombe liueth and enioyeth Transpiration, but after the Infant is born it turneth into a rye or ligament of which we haue spoken sufficiently before.

Presently after when it hath assumed a propagation which is sent obliquely downward from the external branch [ta. 17, s] where it is about to fall into the Legs [ta. 17, y] it passeth through the hole of the share-bone, and is dispersed into the muscles which occupy that hole, and into those that neighbour about it.

The Exterior branch of the byfurcation sendeth out two branches, one before it hath passed the *Peritoneum*, another after.

The first is called *Epigastrica*, [T. 17 char. 22] and reflected vpward, climeth ouer the right muscle, and his especiall branches about the Region of the Nauell are ioyned with the mammary; the rest of his furcles he disperfeth transuersly into the lower side of the *abdomen*.

The second is called *Pudenda* [Ta. 17 char. 15] a little branch not deuided into so many furcles as is the veyne. It runneth transuersly and inward along the commissure or ioyning together of the share-bones vnto the Priuities, and is consumed in the skin of the yard. Sometime also small arteries are sent vnto the glandules of the groyne: againe often from one side a reasonable branch is produced vnto the groine, which cheriseth not onely the skin about the share, but also those parts which pertaine or reach vnto the haunches or the *abdomen*. The remainder of the artery [ta. 17 char. 18] runneth into the Leg and maketh the *Cruall* arteries, of which we shall speake in the 20. Chapter. And thus much of the branches of the great Artery which accompany the hollow veine in the lower belly. Now we come vnto those that accompany the Gate veyne.

CAP. XVI.

Of the Arteries accompanying the branches of the Gate-veine through the lower Belly.



Celiaca.

THE Arteries which accompany the branches of the Gate-veine are three. The first is called *Celiaca* [tab. 18, fig. 1, m. table 17, char. 6,] the second *Mesenterica superior*, [tab. 17, char. 10,] the third *Mesenterica inferior*, [Tab. 17, char. 12,] the *Celiaca* [tab. 18, fig. 1, m. tab. 17, char. 6,] is so called because it sendeth many branches vnto the stomacke, and therefore we may call it the stomacke artery. It is a notable vessell and because like the gate-veine it offers his branches to the stomacke, the kell, the *Duodenum*, the beginning of the *Ieiunum*, a part of the collicke gut, to the Liuer, the bladder of gall, the *Pancreas* and the spleene, we will fit his names vnto the names of the gate-veine.

The division thereof.

It ariseth from the forepart of the body of the great artery at the spine of the backe. And the vpper part thereof is sustained in his course by the lower membrane of the *Omentum* or kell. Afterward it is diuided into two branches, a right [Tab. 18, fig. 1 u] which is the lesser; and a left [Tab. 18, fig. 1 u] which is somewhat greater. Both of them spring as it were out of one roote, and vnder the back-side of the stomacke are fastened to the gate-veine in the *Pancreas*.

The right [tab. 18, fig. 1 u] ascendeth vpward into the hollow part of the Liuer, hauing some part of his way sprinkled branches, some from his vpper part some from his lower. From his vpper part two.

Gastrica dextra.

The first is called *Gastrica dextra*, the right stomacke artery. [tab. 18, fig. 1 p] It issueth out of the middle of the passage and distributeth his furcles into the back-side of the right orifice of the stomacke.

Cystica gemella.

The second are two small twin-branches called *Cystica gemella*, [tab. 17, char. 8, tab. 18, fig. 1, fig. 2, x] because they go vnto the bladder of gall. From the lower branch issue three branches.

Epiplois dextra.

The first is called *Epiplois dextra* the right kell artery, [tab. 18, fig. 1 o fig. 2, b] and is offered to the right side of the lower kell, and to the collicke gut which is fastened thereto.

Intestinalis.

The second is called *Intestinalis* the gut artery, [tab. 18, fig. 1 q, fig. 2, d] and is sent vnto the *Duodenum* and the beginning of the *Ieiunum*.

Gastro-epiplois dextra.

The third is called *Gastro-Epiplois dextra*, the right stomacke and kell artery. [tab. 18, fig. 1, r,] It is larger then the former, and is retorted or bent backward to the right side of the bottome of the stomacke, and leaning vpon the vpper membrane of the kell, sprinkleth very plentifull furcles into the fore side and hindside of the bottome of the stomacke, as farre as vnto the middle thereof. That which remaineth of the right branch determineth into the hollow part of the Liuer, [tab. 17, char. 7 tab. 18, fig. 1, t, fig. 2, y] yet not deepe, to conuaye vnto it vitall spirit.

Arteria splenica.

The left branch [tab. 18, fig. 1 u] which is also called *Arteria splenica* the Artery of the spleene passeth with an oblique and crooked course through the *Pancreas* [tab. 18, fig. 2, e] vnto the spleene. [tab. 18, fig. 2, m] It is larger then the right branch that it might not easily be obstructed, for it doth not onely suggest into the Spleene plenty of vitall spirits, but also vomitteth out and purgeth into the same the thicker and more foeculent matter of the spirituous blood contained in the great Artery. It is fastened to the splenicke veine and is distributed like vnto it, for from it before the diuision there issue from the vpper part two Arteries, and as many from the lower.

His diuision.

Gastrica maior.

The first that issueth from the vpper part is called *Gastrica maior*, the greater stomacke Artery [tab. 18, fig. 1, x] which offereth to the stomacke a propagation in the backe and vpper part; wherefrom a furcle [tab. 18, fig. 1 y] runneth vnto the middest of the stomacke.

Coronaria stomachica.

Another also called *Coronaria stomachica*, the Crowne artery of the stomack, [tab. 18, fig. 1, ch. 2, fig. 2, g] which reacheth to the vpper orifice compassing it about like a crowne, and it alloweth small furcles to the body of the stomacke and to the gullet.

Gastrica sinistra.

The second is called *Gastrica sinistra*, the left stomacke artery. [tab. 18, fig. 2, a] It is a propagation of the former *Gastrica maior* running on the right hand into the vpper parts of the stomacke, and distributing furcles on both hands which attaine vnto the *Pylorus* or lower mouth of the stomacke.

Epiplois postica.

From the lower part of the left branch yssue likewise two arteries. The first is called *Epiplois postica*, [table 18, fig. 1, b fig. 2, e] the hinder kell-artery, which presently is diuided into

into two furdles separated farre one from another, and those into others which are propagated into the lower membrane of the kell and the collick-gut which is tyed thereto.

Table 18 is the same with Table 4. Lib. 3.

The second is called *Epipliois sinistra*, the left kell-artery. [Table 18, fig. 1.] It is also sent to the lower membrane of the kell and runneth out into his left side. That which remaineth of this branch [Table 18, fig. 1, u] attaineth to the spleene, and is divided into an vpper and a lower branch, and these againe are divided into others vntill many branches doe touch the hollow part of the spleene, [Table 18, fig. 1, s] and are dispersed through his substance.

Table 19 is the same with Table 7. Lib. 7.

Out of the lower part of this remainder issueth that artery which is called *Gastro-epiplois sinistra*, [Table 18, fig. 1, e] which is supported by the vpper membrane of the *Omentum*, writen toward the right hand that it might creepe vp the left part of the bottom of the stomacke, and sendeth crooked and bent branches to the fore side and back-side thereof, and to the vpper membrane of the kell.

Out of the vpper part of the remainder issueth that which is call *Vas breue arteriosum*, That short arteriall vessell, which is inserted into the vpper part of the left side of the bottom of the stomacke.

And this is the diuision of the *Celiacall* Artery in the lower belly which is the first of the three that accompany the branches of the Gate-veyne. The second and third are the two *Mesenterick* Arteries both which yssue from the fore side of the trunk, the vpper below the *Celiacall*, the lower below the *Spermaticall*.

The vpper *Mesentericall* artery [Table 17, char. 10, Table 18, fig. 1, 2, fig. 2, p] is propagated into the vpper part of the *Mesentery*, yea almost into all of it, and sprinkleth abundant furdles into the *Ieiunum*, the *Ilium*, and the *Collick* guts at the right kidney.

The lower *Mesentericall* artery, [Table 17, char. 12, Table 18, fig. 1, q] runneth vnder the lower side of the *mesentery* & is especially distributed into the left side of the collick and into the right gut, and descending together with the veynes vnto the fundament, maketh the *Hemorrhoidall* Arteries. [Table 18, fig. *]

The vse of these *Mesentericall* branches is not so much to conuay heat vnto the parts, as by their motion and vitall spirit to perferue the *Mesentery* and the guts from corruption and putrification.

Some are of opinion that these branches do sucke out of the guts the purest part of the chylus for the generation of arteriall blood and conuay it to the left ventricle of the heart: but the values which are set at the beginning of the great artery, and shutte vp the passage from the artery into the heart onely, and not out of it againe, do contradict strongly that conceite.

Hauiing thus brought the great artery through the middle and lower regions of the body, we will now returne vnto it againe, where we left it in the 14 chapter diuided into two *Soporary* Arteries and climbing vnto the Head.

CHAP. XVII.

Of the Arteries of the Braine.



HE artery called *Carotis* or the sleepey artery, and by *Archangelus* *Arteria Iugularis* because it is accompanied on the inside with the internall Iugular veyne, ascendeth vnto the chops on either hand by the sides of the rough artery, and there is diuided into two branches. One externall, of which we shal speake in the chapter following. Another internall, which is also the larger conuayed to the Chops, which hauiing afforded certaine furdles to the tongue and the *Larinx* is diuided at the basis of the braine [Table 19, fig. 13, B] into two vnequall branches.

The first artery of the braine according to *Bauhine*, according to *Vesalius* the 3, [Table 19, fig. 13, L. 15, c] is little lesser then the Trunke it selfe, & runneth vp whole & full til it come vnto a proper hole bored for it in the temple-bone, and through it attaineth into the cavity of the scull at the saddle of the wedge-bone, & being yet vnder the *Dura mater*, first of all it affordeth a branch on each hand into the side of the same *Meninx*. [Tab. 19, fig. 15, D] Afterward in brute beasts it parteth with an infinite number of furdles, and maketh that texture which is called *Rete mirabile*, the wonderfull Net: of which *Galen* wrote so curiously that *Vesalius* followeth him to a haire, and that figure is the 14 of this 19 Tab. but the 16 fig. of the same table exhibiteth the form thereof, as it appeareth in brute beasts, especially in oxen, calues, & sheepe.

In men though there be indeed such a knot or texture, yet it is not so notable, and but a very shadow in respect of that in brute beasts, and yet notwithstanding the Artery is not consumed into these propagations but remaineth alwaies sound. [Tab. 19, fig. 16, B c] Presently after it perforateth the *dura meninx* and runneth sometimes single, sometimes double, [ta. 19, fig. 15 P] yet so that it presently vniteth againe, and when it hath transmitted the lesser branch [K] through the second hole of the wedge-bone, it creepeth out of the scull vnto the eye and the temporall Muscle [table 19, fig. 11 H] together with the Opticke nerue to giue it and his Muscles life, and sendeth the greater branch vpward, which presently at the side of the Flegmaticke Glandule is diuided into two branches. The inner whereof is vnited with the inner artery of the opposite side, and so being vnited they are consumed into many smal arteries which at the originall of the optick nerues are disseminated through the *Pia Mater* and the substance of the Braine. [Table 19, fig. 13, e] The other being reflected [table 19, fig. 13, at the uppermost A fig. 15 G] and entangled in the *Pia Mater*, runneth into the forward ventricle diuided into many small branches, some of which are vnited with those small arteries which attained hither from the *Cervicalis* or artery of the necke through the basis of the Head vnder the Braine. Some others run disioyned through the *Pia mater* or thin membrane and through the substance of the Braine it selfe, which with other surcles make the complication of vessels which they call *Plexus Choroïdes*, so that this complication is compounded of foure arteries.

Plexus Choroïdes.

The 2 Artery.

The pulse of the Nose.

The 3 Artery of the Braine.

The fourth.

The use of the arteries of the Braine.

The second Artery of the Braine [ta. 19, fig. 13, q] is a branch of the former which runneth obliquely, and when it hath attained into the scull through the second hole of the Temple-bone, it is diuided into two branches; whereof one runneth outward and the other inward. The vter which *Vesalius* calleth the second small branch of the third artery [tab. 19, fig. 13 f] tendeth through the eyght hole of the Wedge-bone into the cavity of the Nosethrilles [Tab. 19, fig. 15 E] where the Pulse is felt, and offers a little surcle to the end of the Nose [tab. 19, fig. 13, t] but the interiour branch is diuided into two at the first Hand [tab. 19, fig. 13 uu] which *Vesalius* calleth two great branches of the third artery. Afterward it sendeth out of his vter part another small branch, [Table 19, fig. 1, r] which *Vesalius* calleth the first small branch of the third Artery; this branch together with the second Veine, [F] & after the same manner and for the same vse is distributed into the *dura meninx* or thicke Membrane.

The third Artery of the Braine which according to *Vesalius* and *Platerus* is the second, [tab. 19, fig. 13, l] is lesse then the first and runneth together with the branch of the internall Iugular veine [tab. 19, fig. 13, C] vnto the backside of the Scull, and hauing afforded a surcle vnto the Muscles which occupy the inside of the necke [e] it entreth in at the first hole of the Nowl-bone, and so passeth into the *sinus* of the *dura mater*.

The fourth Artery (which according to *Vesalius*, *Falopius* and *Platerus* is the first) is a propagation of that axillary artery being yet within the Chest which is called *Cervicalis*. This arising vpward through the holes of the transuerse proecesses of the neck, after it hath giuen some surcles to the muscles thereabout, betwixt the head and the first Racke of the necke it perforateth the thicke membrane which inuesteth the spinall marrow in the side thereof: to which after it hath giuen some propagations it entreth into the cavity of the Scull through the great hole. Afterward vnder the marrow it is ioyned with his companion of the opposite side, which being so vnited doe passe along vnder the middle of the basis of the Braine till it come vnto the saddle of the Wedgebone wherein the Phlegmaticke Glandule is contained. There againe it is diuided into two branches. The right runneth to the right side of the saddle, the left creepeth on his owne side as farre as to the second paire of sinewes, where on both hands it is diuided into infinite surcles and disseminated betwixt the first and second paire of sinewes, and complicated or intangled with the *Pia mater*, which complications afterward do make the *Plexus Choroïdes*. And thus much of the distribution of the arteries within the braine.

Moreover, we must imagine that frō these sleepey arteries an innumerable number of surcles or propagations are sprinkled heere and there throughout the whole substance of the Braine.

The Vse of the arteries of the Brain is to be considered either as they are Canales or pipes running through the Braine, or as they are perpetually mooued.

In the first consideration they were made to conuey vitall Blood from the Heart vnto the Braine, as also vitall spirits to sustaine the vitall spirits that are bred and seated in the substance thereof; neither do they carry vitall spirits onely, but also the vitall faculty furnished with all his indowments.

As

As they beat continually, their vse is perpetually to ventilate the ingent heat of the Braine, which otherwise would quickly languish and be extinguished. Again, this pulsation moueth and worketh the blood in the veynes, which if it stood still and at rest would like standing water sooner putrifie and corrupt. Finally, to sollicite the Alimentary blood which is thicker, to issue out of the veines through small pores and vents or breathing passages into the substance of the braine (which also doeth somewhat drawe it) for his nourishment and refection.

Now we proceed vnto the exterior branch of the Sleepy Artery.

CHAP. XVIII.

Of the Arteries of the Face, the Eyes, the Nose, the Teeth, and the Larynx.

THE Carotides or sleepy Arteries [Table 16, X R] being on both sides one, doe accompany the Iugular veines by the sides of the necke, and cleauing to the Rough artery ascend vnto the head, and when they come vnto the Chops they are deuided [Table 16, f f] into an vter branch [g] and an inner, [h] the distribution of the inner we had in the former Chapter.

The diuision of the sleepy artery.

The vter which is smaller then the inner and consisteth without the Choppes, lendeth surcles to the Cheeks [l] and to the muscles of the Face, afterward when it cometh vnto the roote of the Eare [m] it is deuided into twaine, one of which runneth to the back-side of the Eare, [o] from which two arteries vnder the Eare doe passe into the neather law, and throughout the length thereof are disperfed vnto the roots of all the lower teeth; another part of it breaking out through a hole at the Chiane runneth along the Lip; another yet [n] creepeth vp the Temples and the forehead, and is consumed into the muscles of the Face. Of the Arteries of the Eyes we haue spoken before in the former Chapter, as also of the Nose; of the Teeth a litte before, whence it is that we often find pulsing or beating paines in them, such as we feele in inflammations of fleshy parts, and this was Galens obseruation in the 8. chap, of his first Booke de compositione medicamentorum secundum loca, who found in himselfe not onely the paine of his Teeth, but also their beating or pulsation, wherefore he affirmeth confidently that there is one kinde of paine in the gums and another in the substance of the Tooth, and without the inflammation of the Gummes sometime in the proper body of the Tooth, sometimes in the Nerue paines doe perplex vs. And truly if there were no Artery at the roote of the Teeth, how could it be that when a Tooth is perforated, so much cleare and perfect blood should issue out from it? Which as Eustachius saith he obserued in a man who had so great a fluxe of blood from his tooth that almost powred out his life therewith.

Galens

That there are arteries in the teeth.

Eustachius his obseruation.

Finally, which we also partly remembred before, from the greater and inner bough of the sleepy artery which runneth vnder the Chops, some surcles are communicated to the throtle and Tongue to conuay vnto them life and heat: and thus much of the diuication of the Soporary or sleepy arteries both without the Scull and within: it remaineth that we should entreat of the Axillary and Crural arteries, as they are distributed into the ioynts, but we will begin with the Axillary.

CHAP. XIX.

Of the arteries of the Hand in the large acception.



THE great Artery after it is out of the Chest distributeth foure branches from each side of the Axillary; the first from the back-side to the Muscles situated vpon the shoulder blade; [table 10 fig. 2, I] another from aboue the ioynture of the Arme with the blade, which the Humerary veine accompanieth for a time: [K] the third to the Muscles that lye vpon the forepart of the Chest, [L] the fourth runneth downward along the sides of the Chest [M] and communicateth small branches to the glandules vnder the arme-pits betwixt the third branch and the fourth; of these we haue spoken before: the remainder is conuayed vnto the hand [from N.]

4. branches from the axillary.

For this branch [N] descending through the inside of the Arme together with the Basilica veine [table 20, fig. 1 m] betwixt the muscle called Biceps or the two headed muscle, distributeth small surcles on either side to the muscles which take vp the inside of the arme. [vnder M] Afterward being accompanied with the Deepe-veine [tab. 20, fig. 1, q] or the inner branch

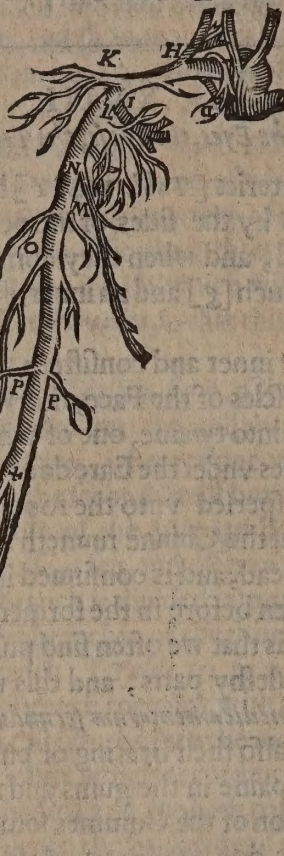
Table 20. Figure 2. sheweth the branches of the great Artery, running thorough the whole hand.

TABVLA XX.

FIG. II.



FIG. II.



G, The Mammary artery fastened on the one side into the breast-bone.

H, The Artery of the necke, called *Cervicalis*, going to the backward muscles of the necke.

I, *Scapularis*, going to the muscles of the shoulder-blade.

K, The Artery climbing vnto the top of the shoulder.

L, *Thoracica superior*, going to the muscles that lie vpon the breast.

M, *Thoracica inferior*, creeping along the sides of the Chest.

N, The axillary artery attaining vnto the arme, and bestowing small branches vnto the muscles.

O, It attaineth to the outside of the cubite.

PP, Vnto the ioynt of the cubit.

†, The by-partition of the Artery vnder the bought of the Cubite.

Q, An vpper branch of the Artery carryed along the Wand.

R, A furcle going vnto the vtter sides of the hand, where wee vse to feele the pulse.

S, The lower branch of the artery running along the *Vlna*.

* A small branch to the muscles, about the little finger.

T, The distribution of the vpper and inner branches, into the hand and into the fingers.

of the *Basilica* (where to it is fastned in his whole course) as also with the fourth Nerue of the arme, it runneth through the backside into the outside of the cubit vnder the heads of the muscles thence arising, and shooteth forth small branches aboue and below [O] and neere the bent of the elbow it affoordeth on either side two branches to the ioynt [PP] where the pulse may be oftentimes evidently felt.

Galen.
The *Anastomosis* of the vessels.

We said that the Artery runneth with the veine, For it is certaine (saith *Galen* in the 10 and 17 chapters of his sixth Book *de vsu partium*) that in the whole body there is a mutual *Anastomosis* or *inoculation* between them, that is, their mouths open one into another, and so a *Conspiration* and *Communion* of their matters. For the arteries doe impart vnto the blood spirits and vitall heate, and for retribution the arteries draw out of the veines blood which is the nourishment not onely of their spirits but of the arteries themselves; and these coniunctions of the vessels made by their orifices or mouths are found especially in the armes and the legges, and therefore it hapneth sometimes that one only veine being wounded, not onely all the naturall blood of the body but together with it the vitall also issueth, and so the wounded man perisheth. And this *Galen* also intimateth; for going about to demonstrate the vnions of the vessels, he saith, that if the greater veynes be wounded, if the blood be suffered to flow forth, the Arteries also will be euacuated by consequence: and this appeareth true by experience. For if you open a man that dieth of bleeding, you shall finde not onely the veynes but the arteries also empty. But I returne from whence I haue digressed.

Galen.
The axillary Arteries descent.

The Axillary Artery vnder the bent of the Cubit when it hath run a little way thorough the inside of the Cubit, descendeth into two bending muscles of the fingers, and is diuided into two notable branches, *Columbus* addeth oftentimes into three. The one is the vpper and passeth along the *Radius* or wand [Q] till it come in a straight line vnto the wrest, at which place the Physitians commonly feele the pulse, making estimation of the disposition of the heart from the Dilatation, Contractiō, and intermediat Rest of the artery. Yet, saith *Colum.*

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but, this is not alwayes seated in the inside of the wrest, but runneth sometimes outward, so that if a Physitian be ignorant of Anatomy, and search for the sicke mans pulse only in the usuall place which is in the inside of the wrest a little about the roore of the thumbe, not finding it, he will determine that the Patient is neere his death, when haply the artery beatech well on the vpper side against that place.

The pulse in the wrest. Note this.

Before the artery of the pulse get vnto the fingers it sendeth a shoote toward the out-side of the hand [Table 20, R] betwixt the first bone of the thumbe and that of the afterwrest where-by the fore-finger is supported, and distributeth it into the muscles of that place. Afterward it goeth vnder the Annular or transuerse ligament, and the tendon of the muscle of the Palme (as also do the veyne and the nerue fastened thereto) and is diuided into three branches. The first of these offers two furcles to the inside of the thumb, the second to the inside of the fore-finger, the third is vadiuided and attaineth to the middle finger, [Table 20, between R and T.]

Three branches to the fingers.

The other and inferior branch (of which *Columbus* maketh no mention) [Table 20, S] runneth directly along the *Vlna* or *El*, and attaineth likewise to the wrest, at which place also we may feele the pulse to beate, especially if the party be leane, or haue a great pulse, and this is the reason why we rather touch the other artery then this, for the other is lesse covered by the tendons and offereth it selfe more manifestly that we may giue the better iudgment by it.

The lower branch of the Artery.

This branch also runneth vnder the fore-side transuerse ligament into the palme of the hand, and before it reach vnto the fingers affoordeth a small branch [Table 20, *] to the muscles that are seated neere the little finger. The remainder accompanied with a veine and an artery is communicated to the fingers: the middle finger hath one furcle, the ring-finger and the little finger each of them two. The outside of the hand as it wanteth muscles so it wanteth arteries also, vnlesse it be that branch which is marked with R. And thus much of the Arteries of the Hand.

His diuision.

CHAP. XX.

Of the Arteries of the Foot in the large Acception.

Whe said before that the great Artery about the lower spondels or rack-bones of the Loynes, or aboue the beginning of the *Os sacrum* or holy-bone, is diuided into two notable Iliacke branches. [Table 21, v.] Each of these is againe subdiuided on either side into two others, one exterior the other interior. [Table 21, § 1.]

The diuision of the Iliacke Arteries.

The interior [§ and Table 17, §] shooteth out two scions, one externall [o and table 17, §] called *Muscula inferior*, the lower Muscle artery which runneth ouerthwart and is consumed into the muscles that couer the outside of the haunch-bones and the ioynt of the hip: the other internall, [o and table 17, u.] called *Hypogastrica*, which runneth directly downeward and sendeth his furcles to the parts of the *Hypogastrium* or *Water-course*, as the bladder, the womb, &c. The remainder of this branch [Table 21, §] descending [vnder s] first admitteth the vmbilicall artery of his owne side; after it assumeth a portion from the outward branch of the first diuision [neere o;] and so increased it passeth through the hole of the share bone into the leg, and is distributed into the muscles which occupy the share-bone; thirdly in the end it ioyneth [table 21, §] with another artery. [4.] The vtter branch or the stocke it selfe running downeward accompanied with his veine whilest it is yet in the belly [aboue o] sendeth one branch vpward and outward through the cavity of the *Abdomen* called *Epigastrica* [table 21, §, table 27, char. 22.] vnto the muscles thereof, and another inward called *Pudenda* [table 21, §, table 17, char. 15,] which issueth from the Artery sometime within the *Peritoneum* sometimes without, and runneth along the share-bone; but of these we haue spoken before in the 15 chapter, and repeated them briefly heere to make better way vnto that which followeth.

The Iliacke trunk of the great artery when it hath passed through the *Peritoneum* and the cavity of the belly in the thigh, is called *Cruralis*. [table 21, §, table 17, char. 16,] and from it branches on either side are propagated and disseminated into the whole foot, eight in number.

The first is called *Muscula Cruralis exterior*, the vtter crurall muscle Artery. [table 21, §.] It issueth out of the outside of the crurall trunk, and running downeward is consumed into the foure muscles that compasse that bone of the thigh.

Mus. Cr. ext.

The second is called *Muscula cruralis interna*, [table 21, §] because it riseth out of the inside

Mus. Cr. inter.

Table 21. Sheweth the distribution of the great Artery into both the feet.

TABVLA XXI.



toes themselves, betwixt the tendons of their muscles. *a, b*, the diuision of the branch ω into 5 to the great toe, fore-toe, and the middle toe. *d*, the diuision of the exterior branch vnto the middle toe, and the next vnto it.

side of the aforesaid trunk sometime answering in opposition to the former, and is distributed into the muscles which occupy the inside of the thigh, and falling downe vnto the knee, a small branch thereof is mixed ω with the last branch of the *Hypogastricke* artery.

Poplitea.

The third is called *Poplitea*, [tab. 11, T] the crural trunk creeping downward vnder the hamme, being accompanied with a large veine, maketh this propagation: some surcles thereof runne out into the backward muscles of the thigh, the rest descendeth a good way to the hamme-veine.

Suralis.

The fourth is called *Suralis*, the trunk lurking in the hamme or a little vnder it, shooteth out on each side a deepe propagation, [tab. 21, $\Delta\Delta$] which are consumed, partly in the ioynt of the knee, partly into three muscles of the foot which make the Calfe, & take their originall thereabouts. And these are the foure arteries which arise from the trunk in the region of the thigh, from hence it descendeth to the hamme [tab. 21, Θ] together with the interior veine, partly to the leg, and partly to the foot; when it is drenched within the muscles of the leg it is diuided into three notable branches, [tab. 21, $\Lambda\Sigma\Pi$].

Tibia exterior.

The first which is the first of these three [Δ] is called *Tibia exterior*, the outward leg artery. It is a notable branch of the vter veine, and so descendeth along the Fibula or Brace, and is consumed into the muscles which occupy the leg as farre as they are fleshy.

The

a, The lower mesentericall artery.

mm, *Lumbares* which runne in knots or knees into the spondels of the loynes.

rr, The diuision of the great artery into Iliacke branches about the holy bone.

ξ , the diuision of the right Iliack into an inner branch at ξ , and an vter at σ .

o, *Muscula inferior*, an vter propagation of the inner branch going into the muscles covering the ioynt of the Coxendex.

n, *Hypogastrica*, an inner propagation of the inner branch at ξ , going to the bladder, the yard, and the wombe, &c.

$\rho\sigma$, the coniunction at σ , of the vmbilicall veine ρ , with the branch ξ .

xx, *Epigastrica*, which is sent vpward into the right muscles of the *Abdomen*.

u, *Pudenda*, which creepeth transfuersly along the share-bone vnto the priuities.

ϕ , the externall Iliacke branch.

χ , the outward crural *Muscle-Artery*.

ψ , the internall crural *Muscle-Artery*, which is sent to the muscles of the thigh on the inside.

ω , the coniunction of this Artery with a branch of the *Epigastricke*.

I, *Poplitea*, or the artery of the hamme.

$\Delta\Delta$, propagations of the surall Artery on either side going vnto the ioynt of the knee, and three muscles of the foot.

Θ , *Suralis*, the artery of the Calfe which descendeth with the inner veine, and is diuided into three branches, $\Lambda\Sigma\Pi$.

Δ , *Tibia exterior*, going vnto the muscles of the foot.

$\Pi\phi$, the lower and backer *Tibia*, hidden within the muscles, attaineth vnder the transfuers ligament to the vpper part of the foot at ϕ , and is consumed into the muscles of the toes.

$\Sigma\psi$, the lower, the trunk of the crural artery betwixt the heele and the inner artery, to which it offereth a branch marked with ψ , which runneth to the vpper side of the foot.

Ω , the remainder of the Crural artery going to the

toes themselves, betwixt the tendons of their muscles. *a, b*, the diuision of the branch ω into 5 to the great toe, fore-toe, and the middle toe. *d*, the diuision of the exterior branch vnto the middle toe, and the next vnto it.

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The sixt *Cruall* Artery is the second of the forenamed branches [table. 21, 2] and is called *Tibiaa posterior elatior*, the vpper and backer Leg artery. It yflueth a little below the former out of the backer and lower part of the trunk, and descendeth as far as to the commixtion of the tendons of the muscles that make the Calse, being accompanied with the hinder branch of the *interior* veine.

The seauenth which is the third and last of the foresaid branch [Table, 21, 11] is called *Tibiaa posterior et humilior*, the lower and backer Leg Artery. It ariseth out of the backward and exterior part of the trunk, and being accompanycd through the membranous Ligament (with the fore-branch of the inner veine) which ioyneth the *Brace* vnto the *Leg*, it is hidde within the muscles, and runneth forward and downward further then the other two till it passe the transuerse Ligament and attaine to the top of the foote, [Table 21, q] from whence it is disseminated into the muscles that leade the Toes backward, at which place *Vesalius* and *Platerus* say that the pulse may be easily felt.

The eight Artery of the Leg is nothing else but the remainder of the *Cruall* trunk descending along the backside of the *Tibia* or Leg, [table 21, the lower 3] betwixt the 2. and 3. muscles of the Toes, and so it passeth betwixt the heele and the inner ankle vnto the soale of the foot, but at the inner ankle it offers a branch to the foote, [table 31, 4] which reacheth to the muscle of the great Toe, and creepeth a good way vpon the top of the foote.

That which is left [Table 21, a] amongst the tendons of the muscles of the Toes, is deuided into two branches [a b] each of which departeth into 5. surcles: for the inner branch [c] affordeth two to the great Toe, two to that next it, and one to the middle. The exterior [b] offereth two to the little Toe, two to that next it, and one to the middle Toe [d] and the lower side thereof.

And thus much concerning the distribution of the great Artery throughout the whole body. It remaineth that we come vnto the third sort of vessells which are the nerves, for whose prosecution we haue set aside the third part of this Booke.

The third part of the Eleauenth Booke

concerning the Nerves.

CHAP. XXI.

Of the Nerves in Generall.



AS the Naturall Faculty together with the Bloud and the thicker Spirit is deriued through the Veines; the vitall with Bloud and a thinner Spirit through the Arteries as through Canales and Water-courses into all the parts of the body: so the Animall Faculties, that is, of *Sense* and *Motion* are conuayed into those parts which are capable thereof with a subtle and fine Spirit along by the Nerves as it were by the strings of an Instrument.

The Natures, Vses and Diuisions of the Veynes and Arteries we haue vnfolded in the two former parts of this Booke, and are come in this place to the structure, differences and diuarcations of the Nerves.

The Grecians call Nerves *νεῦρα*, the acception of which words among the Philistians is manifold. *Erotianus* thinketh that *Hippocrates* vsed the word *νεῦρα* for all sortes of vessells, Veines, Arteries and Nerves. *Galen* in his first Booke *de motu musculorum*, in the beginning of his Booke *de ossibus* and in many other places, maketh three kinds of Nerves which appeare without blood and without any hollownesse.

Of these Nerves some proceed out of Bones, others out of Muscles, others are deriued from the Braine and the spinall Marrow. Those which issue out of the Bones and their protuberations are called *σύνδεσμοι*, *Vincula*, Tyes, Bands or Ligaments. Of these we shall heare particularly in the next Booke. Those Nerves that issue out of Muscles are parts of the Muscles, and are called *ἀπὸ τῶν ὀστέων*, that is, nervous propagations and Tendons.

Now a Tendon is nothing else but an excreffence or out-growing of the Fibres of a Ligament and a Nerue, which being sprinkled through the flesh doe meete together as it were in one Chord, by which chord the Ioynts are ledde according to the good pleasure

Tibiaa posterior elatior

Tibiaa posterior et humilior

What the eight artery is;

The names of Nerves and their kinds.

sure of our will. The third kind of Nerves are those which the Physitians doe properly call *νεύρα ἐκ τῶν ὀστέων*, and that from their office; *νεύρα*, because they doe *nutare sine flectere*, that is, incline or bend, and *τῶν ὀστέων*, because they doe *Tendere*, that is, stretch. These Nerves doe arise from the Braine and the spinall Marrow, and are called by *Galen*, *organa ὑποκείμενα*, Instruments of Sense and voluntary Motion, because by them the animall Faculty, and those that moue within, that is, the impetuous spirits, are conuayed as it were by strings or chords into the particular parts. *Anicen* calls them *Latores*, cadgers in our language. Of these *Hippocrates* wrote in his booke, *De locis in homine*, The whole body is full of Nerves, that is, throughout the whole body the Nerves doe run from the Braine and the Spinall Marrow: and in his Booke, *De arte*, he calleth them *metecors* in the flesh, because they are sprinkled through the flesh, that is, through the Muscles.

Compared together.

Galen in his first Booke, *de motu Musculorum*, compareth these three kinde of Nerves among themselves on this manner, A Ligament is insensible, a voluntary Nerve of most exquisite Sense, and a Tendon of a middle nature, not altogether insensible, because it hath some filaments or strings of Nerves therein, neither yet of so quicke a Sense as is a Nerve.

There are also many other parts in the body, which because of the similitude betwixt them and Nerves are called *neruosi*, although they cannot be referred to any of these three kinds: so we say the wombe, the bladder and the guts are neruosi, as also the vreters, the passages of the choller, and the eiulatory vessels. In this place we take the name of a Nerve properly for an organ by which the animall spirit and the faculty floweth into the whole body. The nature of this Organ may thus be described.

The description of a nerve.

It is a common Instrument of the body like a Chord, white, round and long without any cavity, which our sense can discerne (vlesse it be the Opticks) but porous, in some vnited, in the greater Nerves made vp of many small strings, and carrying as a Canale sense and Motion which are conducted by the animall spirit from the Braine and the Marrow thereof vnto those parts of the body which are capable of Sense and Motion.

Their substance.

Their substance is white and marrowy, much like the marrow of the Braine, from which they take their originall (for I account the marrow of the Braine and the backe to bee of one and the same substance) but more compact and faster, for it was necessary the Braine should be very soft, because it was to receiue the species or formes of sensible things. So that by how much the Nerve descendeth lower, or is more separated frō the Braine, by so much doth it become the harder, that it might be better able to endure outward iniuries.

Membranes.

They are inuested with a double membrane, produced from the two Meninges or Membranes of the Braine, the vtter whereof is the thicker produced from the *dura mater*, whose office is to safegard and defend the marrow of the Nerve, and if it consist of many small chords or threds, it ioyneth them altogether, and when it hath encompassed them about, it receiueh into it branches from the neighbour-veines.

Fernelius

The inner membrane is thinner by much, and lyeth next vnto the marrow or substance of the Nerve. It ariseth from the *pia Mater*, and hath the exquisite sense of touching, which saith *Fernelius*, it communicateth to the parts whereinto the nerve is inserted; for as the Braine is couered with these two membranes, so also are the Nerves throughout the whole body, a Nerve being nothing else indeed but a production of the Braine. But this threefold substance of a Nerve, as *Falopinus* hath it in his obseruations, and out of him *Bauhine*, may better be distinguished by reason, then by sense, for Anatomy is not able to shew the difference betwixt the hard and soft membranes of any Nerve, except it be the opticks.

Which is their chiefe part.

The substance which is in the middest, or in the center of the Nerve, is the principall part thereof and performeth the action; for the sensatiue and motiue faculty is conuayed from the Braine vnto the parts, not by the coates but by the marrow. Hence it is, saith *Galen*, that if you cut asunder the marrow of a Nerve, presently the part into which that Nerve is inserted, is deprived of sense and motion; as for the membranes they doe the same office vnto the Nerve which they did to the Braine, for the Nerves are not properly the instruments of sense and motion (for the immediate organ of motion is a Muscle) but they are like pipes by which the whole sensatiue soule and the faculties thereof both sense and motion are led by the guidance of the animall spirit of the Braine vnto the parts of the body as they stand in neede either of sense and motion, and therefore the Physitians doe vse to call them the organs of sense and motion. For they communicate

vnto

vnto those parts into which they are inserted, either sense alone, or onely motion, or both together, for no part hath sense or voluntary motion without a nerve; and if the nerve that belongeth to any part be compressed, or intercepted, or cut asunder, or corrupted, the sense and motion of that part doth suddenly perish.

How a Nerve is the Organ of Sense.

Hence it is (as Aristotle also remembreth in his third Booke *De Historia Animalum*) that no part of the body hath any stupor or dulnesse, any palsee or resolution, any spasme or convulsion that hath not a Nerve in it. Now stupor is a diminution of sense, the palsee a privation of sense and motion, and a convulsion is a motion involuntary against our wils, and a depravation of that faculty.

Galen in the third and fift Chapters of his sixteenth Booke *De usu partium* saith, that those nerves which were made for voluntary motion are hard, and those that were made for sense are soft: and that the soft Nerves doe make for sensation and the hard for motion, nay he goeth further in the eight Chapter of his seventh booke *De Administrationibus Anatom.* and affirmeth that the soft Nerves are onely fit for sense but unfit for motion. Some againe conceive and not without great reason that the softnesse or hardnesse of a Nerve is diversly occasioned, first from the substance whereout they issue, and so the first Nerves which are said to arise out of the Braine are the softest, those harder that arise from the Spinal marrow, and those hardest of all which arise from the marrow contained in the racke-bones of the Loynes and the Holy-bone: Secondly, in respect of their production, so those Nerves are soft which run but a little way, as as if their journey be not out of the skull, whereas those that are led further off as vnto the muscles, are harder then they were at their originall.

The reason of the softnesse or hardnesse of a Nerve.

In like manner those that run anfractuouly, that is, with turnings and windings are very hard, as a branch of the third paire of the Braine. Again, those are hard which passe thorough a hard body, as that surcle of the fift coniugation which creepeth through the hole of the Temple-bone which the ancients called *Cacum* or the blind-hole, is made harder by the contact of the bone then his beginning was. Galen attributeth the cause of hardnesse and softnesse to the counsell of Nature, because, saith he, the instrument of Sense needed a soft Nerve as a Canale to leade along the Animall and sensative spirit, and a soft Nerve, because it was to be affected and to suffer somewhat from the sensible object, applying vnto it from without.

Galen's opinion.

Now, because that which is soft is fitter for passion, that which is hard for action, therefore, saith he, it was necessary that the instruments of the senses should haue soft Nerves communicated vnto them, and the parts which were to be moved by voluntary motion should haue harder Nerves. And this he proueth, because vnto those Instruments of sense which haue not onely sensation but motion, there is a double kind of Nerve communicated, one for Sense, another for Motion; as we see in the eye vnto which the first coniugation is allowed for Sense and the second for Motion; so in the tongue, which receiveth the third and fourth coniugations (so Anatomists doe vsually distinguish them) for Tasting and the seventh for Motion.

By the way hence it appeareth, that Nerves beside their vse haue also an animall action, because they are affected by the object, and therefore the softer Nerves are fitter for sense and the harder for motion. Notwithstanding all this saith *Banbina*, yet we conceive that the Nerves of their owne nature are indifferently disposed both to sense and to motion, so that they may be called *Sentientes* or *Motores*, perceivers or movers from the instruments or parts vnto which they are conducted and in which they are disseminated, for if they bee inserted into the instruments of motion, that is, into the muscles, then are they called *Motory* or moving Nerves: If into the instruments of Sense, then are they called *Sensory* or perceiving Nerves; yea, we see that one and the same Nerve doth convey motion and sense according to the diversity of the instruments; for example, the seventh Coniugation of the Braine, conveyeth vnto the Membranes of the bowels which are in the middle and lower belly, the Sense of touching, and yet the same paire being on either side reflected makes the Recurrent Nerve which distributeth surcles into every muscle of the Larinx or Throate to moue the same. And if the same Nerves should meet with the instruments of Seeing, of Hearing and of Tasting, the same perceiving and moving Nerves would also become Seeing, Hearing and Tasting Nerves.

Banbina's opinion. His reasons.

An instance.

In like manner the Nerves which are conveyed to the muscles to afford vnto them voluntary Motion, doe altogether with that power afford vnto the Membranes of the muscles

cles, into which their fibres doe determine, the sense of Touching, and so it commeth to passe that by the mediation of the Nerves, the Braine is to be found in every part of the body, because the animall faculty which is seated onely in the Braine, doth notwithstanding transfuse it selfe through the Nerves.

The uses of the Nerves.

Although out of that which hath been said, we may easily collect the use of the Nerves, yet it shall not be amisse to remember that *Galen* in the ninth chapter of his fift booke, *De usu partium*, and out of him *Vesalius* in the first chapter of his fourth booke, makes a three fold use of them.

The first to convey sense vnto the instruments of sensation, to the eyes, to the tongue, to the eares, and besides these to the palmes of the hands, and the insides of the fingers, yea, to the vppermost mouth of the stomacke also, for these after a sence are organs of sensation. For the best iudge by touching is the hand, and the mouth of the stomacke hath an exquisite sense of the want of aliment, which we commonly call *Hunger*.

The second use is to afford motion to the moveable parts, so the muscles which are the instruments of voluntary motion have Nerves conveyed vnto them, and because they were made to move the whole members therefore their Nerves are great and large, and because the same muscles stood in need of the faculty of discerning Tactile qualities for the security and preservation of our lives, therefore also they had Nerves, by which Nerves they have this faculty of sensation.

The third use is that for which all other parts have Nerves, to wit, that they might perceive those things which would be grievous vnto them: (although this use may well be referred to the former) for so wise, so iust, so skilfull is Nature, saith *Hippocrates* (we say the great God of Nature) and so provident for the behoofe of the creatures, that shee hath distributed Nerves to all the parts, although not in the same measure, but to some more liberally then to other with a straiter hand, and that according to the proportion of their magnitude, of the dignity of their actions, of the intention or remission of their motions, of the assiduity or intermission of their uses. So making an exquisite estimate of the need of the dignity, and of the use of every part, to some she hath allowed greater Nerves, to some lesser, but to every one that is fittest for it.

The magnitude of nerves.

For there is great difference betwixt the magnitude of Nerves; the thickest are those which are distributed vnto the remotest places, and into the most parts, such are they that are sent vnto the ioynts, which because they needed greater abundance of spirits have a greater proportion of originals of sinewes granted them out of the stocke of the spinall marrow which is in the racke-bones of the necke and of the loynes, that from the marrow they might receive a competency of spirits as it were by many rootes, which yet being gathered together doe make one thicke nerve, but are againe though almost insensibly distributed into lesser branches. Those Nerves are Meane which are conveyed to the organs of the senses in the head: for being neare vnto the Braine and very soft, they could not be very small. Those nerves are small which are distributed into the next parts, as into the muscles of the face. Wee will also say something concerning the originall of Nerves.

Their originall.

The originall of the Nerves is not from the heart, though *Aristotle* so conceived in the fift chapter of his third booke, *De historia Animalium*, and in the fourth of his third, *De partibus Animalium*; for in dissection we meet with no Nerve produced therefrom, and those that are led vnto it from the sixt coniugation of the Braine are so small, that *Vesalius* witnesseth that he could find but one, and that with great difficulty.

Neither have they their originall, as *Erasistratus* thought in his youth, out of the *Dura mater*, or thicke membrane of the Braine, as their substance already declared, doth sufficiently witness. But as *Hippocrates*, *Erasistratus*, when he was wiser, *Herophilus*, *Galen*, and most Anatomists doe agree, from the Braine, from which also the spinall marrow draweth his originall. From the Braine I say, which is manifested as well by sense in the dissection thereof, where we see many rivers of Nerves, to which those of the body are continued: as also because their substances are marrowy alike, and cloathed each of them with two membranes.

Moreover, the affects or diseases of the head doe manifestly prove that all sense and motion doe flow from the Braine. So in the Apoplexy which is caused by an obstruction of the passages of the Braine, the Animall Faculty is instantly intercepted, albeit the heart be altogether indemnified. So in the Epilepsie or Falling sicknesse, where the mar-

row of the braine from whence the nerves do issue is affected, the whole body is drawn into Convulsion, which is nothing so when the heart is affected.

But we said before that a beginning is double, one of generation another of Dispensation. In respect of the Generation their beginning is Seede, of which as of their immediate matter they are framed. In respect of their Dispensation their beginning is in the braine, together I meane with the After-braine, which is the originall *à quo* from which, those Pipes (if so you list to call them) which receiue Sense and Motion are distributed into the body, as the part standeth in need of the one, or the other, or both.

Againe, the Nerves are said to be of two sorts, some proceeding from the braine, some from the Spinall marrow, and of these againe some from the beginning of the Spinall marrow, that is, being yet contained in the scull, others from the Spinall marrow which is in the Rack-bones of the Chinne. Againe, of these some belong to the marrow of the Necke, some of the Chest, some of the Loynes, and some of the *Os sacrum* or Holy-bone, to which also we may adioyne the nerves of the Loynes.

Bauhine in this place interposeth his owne opinion, which is, that all Nerves doe issue from the marrow of the braine oblongated or lengthned out, some whilst it remaineth yet in the Scull and some after. But withall he maketh mention of diuers opinions both of the Ancient and late Writers concerning the originall of the Nerves, which discourse of his we will here transcribe but contract it as briefly as we can. He reckoneth therefore eight opinions, for the ninth we thinke not worthy to be remembred.

The first is of *Hippocrates* in his book *de natura ossium* in the very beginning, where he saith that the originall of the nerves is from the Nowle unto the Spine, the Hippe, the Share, the Thighes, the Armes, the Legs and the Foote.

The second is *Aristotles*, who in many places deliuereth that they arise from the heart, because in it there are abundance of nerves (for which he mistooke the fibres) and because from thence motions do arise, & vnder his Ensigne *Alexander*, *Auicen* and the whole schoole of the *Peripateticks* doe merit or band themselves. This opinion of *Aristotles*, *Auerrhoes* and *Aponensis* with some others doe maintaine indeed, but with a distinction, affirming that they issue from the heart, *mediante cerebro*, by the mediation of the braine, or that they arise from the heart and are multiplyed and propagated in the braine.

The third is that of *Praxagoras*, who thought that the Nerves were nothing else but extenuated Arteries.

The fourth of *Erasistratus*, who thought they issued from the *Dura meninx*, but in his age he changed his mind as *Galen* witnesseth of him.

The fifth is *Galen*, who determineth that the Nerves and the Spinall marrow do proceede from the braine.

The sixth is that of *Vesalius*, who saith that some Nerves issue out of the Scull, others out of the Racks of the Spine; those that proceede out of the Scull doe arise from the basis of the forepart of the braine or from the beginning of the Spinall Marrow before it enter into the spondels. The rest from the Spinall marrow remaining within the Rackbones.

The seventh is *Ealopius* his opinion in his obseruations where he saith, that some Nerves (as those that are soft) doe arise from the braine or the marrow within the Scull, others from the Spinall marrow.

The eight is *Varolius* opinion, who saith that all Nerves doe take their originall from the Spinall marrow which proceedeth from the braine and the After-braine, and with him doe *Platerus*, *Archangelus* and *Laurentius* vpon the matter consent, as also doth *Bauhine* as you haue heard before.

The Nerves therefore which issue from the Marrow of the Braine contained yet within the Scull are commonly accounted 7 paires according to *Galen*, some make nine coniugations which are called *Nervi cerebri*. The nerves of the Braine, which may bee expressed in this disticke.

Optica prima, oculos mouet altera, tertia gustat

Quartaque quinta audit, vaga sexta, septima lingua est.

The Opticks first, Eye Mouers next, the third and fourth doe Tast:

The fifth doth Heare, the sixth doth gad, the Tongue claimes seventh and last.

To which also we may adde the organs of Smelling.

Other Nerves do arise from the same marrow after it is false through the great hole of

20 paire of the
spinal mar-
row.

the Nowle-bone, and runneth thorough the holes bored in the Racke-bones of the spine, where it is properly called *Spinalis medulla*, the *Spinal Marrow*. And these are thirty paires or Coniugations, that is to say; seven of the Necke, of the Chest or Backe twelue, five of the Loynes, and sixe of the Holy-bone, from which the nerves of the ioynts doe arise. For the hand receiveth sometimes five, sometimes sixe propagations from the fift, sixt & seventh paires of the Necke, and from the first and second paires of the Chest: the foot receiveth foure Nerves from the three lower paires of the Loynes; and from the foure, sometimes the five vpper-most of the Holy-bone, which are called nerves of the spinal marrow.

These nerves doe issue on either side after the same manner, for no nerve is produced without his companion, and therefore the *Grecians* called them *αὐζύσια*, the *Latines* *Nervorum paria*, or *Coniugia*, paires or coniugations of nerves. All these coniugations, as they doe arise alike, one from the right hand, the other from the left; so are they also distributed after one and the same manner, except onely the sixt paire of the Braine, whose right nerve is not divided as is the left, as we shall heare afterward.

And thus much shall have been sufficient to have said in generall, concerning the nature, differences, use, and originall of the nerves. Now we descend vnto their particular History, beginning with those of the Braine, because thence all nerves take their originall.

CHAP. XXII.

Of the Nerves of the Eyes, or of the first and second Coniugations.

The Mamil-
lary processes.



These two processes of the Braine, called *Mammillares*, which are the instruments of Smelling, doe come to be handled in the first place, but because we have related their History and exhibited the table which belongeth to them in the sixteenth chapter of the seventh booke, we will referre the Reader for his satisfaction vnto that place, and proceed vnto the nerves of the Eyes, whereof indeed we made some mention before, but that briefly, and by the way, as also we have done of the rest of the nerves, because they tooke their originall from the diuers parts of the substance of the braine, which was then the maine substance of our discourse.

The nerves therefore of the eyes are of two sorts: the first are called *Opticks* or *nervi visorij*, because by them we See. The second are called *Oculorum motorij*, the mooving nerves of the eyes, for by them the eyes are wonderfully and sodainly moued.

The Opticks
Nerves.

The Opticks are the first Coniugation of the Nerves of the Braine [tab. 22. fig. 1. and 2. G] which are the thickest of all the Coniugations of the Braine, yea, of all the rest, if they bee not compounded of diuers filaments. And so much the thicker they were, because, saith *Galen*, in the third chapter of his sixteene booke, *De usu partium*, they have sensible cavities, besides of all the other they are the softest.

Their origi-
nall.

They arise vnder the middle of the basis of the Braine, where the marrow beginneth to be lengthened. *Galen* in the third Chapter of his sixteenth booke, *De usu partium*, saith, they arise from both sides of the forward ventricles, to whose ends they are ioyned. Howsoever after their originall they run obliquely togetherward and forward, and when they have gone a little distance, and as it were in the middest of their iourney, they are vnited about the saddle of the Wedge-bone [Tab. 22. fig. 1. H.] not onely by intersection or simple contaction, but by a confusion of their marrowes, being so mingled as they make one common body wherein the two nerves cannot be separated one from another. Presently after this confusion they are againe separated [Table 22. figure 1. above H.] running each of them obliquely outward by a hole of the Wedge-bone, which was made of purpose, commonly accounted for the first hole of the same, and so getting out of the Scull, the right runnes vnto the center of the right eye on the hinder part, and the left vnto the center of the left, as if they were the rootes of the eyes. Notwithstanding *Vesalius* and *Platerus*, doe not thinke that their implantation is into the center, but to the right side ward. In brute beasts indeed they are not implanted into the center, but much lower, for they looke not so much forward as sideward. These Nerves are not dissolued into Fibres as other nerves are, but are spread abroad within the eye, notwithstanding *Vesalius* saith, that he hath obserued them in Swine to consist of many Filaments, as doe the Nerves of the Legges.

Their confu-
sion.

Separation.

The

The substance of the Opticke Nerue is double, Marrowy and Membranous, for the inner part is soft, which you shall perceiue will squeeze out if you presse the nerue hard whilest it is yet compassed with his membranes.

Their substance.

Of this Marrowy substance diffused in the Orbe of the eye, is made that coate which is called *Amphiblestroides*, or *Retina tunica*, from the resemblance it hath with a Net; [tab. 22. fig. 1. and 2. 1.] which notwithstanding, to say truth, is nothing lesse then a coate, because it differeth nothing at all from the substance of the braine, compassing the vitrious humour round about, and the middle part of the eye, that so the visive spirits might be diffused through the cavity thereof.

Retina tunica.

The membranes of the Opticke Nerves are two: one from the *Pia mater*, and another from the *Dura mater*, notwithstanding from their originall to the hole which is in the Orb of the Eye, and wherethrough they passe they are inuested onely with the *Pia mater*, from thence to the eye it selfe they assume another inuolution or vestment from the *Dura Meninx*, which also is consumed into the horny coate, as the membrane they haue from the *Pia mater* is spent into the grapie. Hence it is that by the continuation of this Nerue in a very moment of time the Animall spirit is conuayed vnto the *Pupilla*, or apple of the Eye, which is nothing else but the perforation or hole of the grapy coate. And therefore when one eye is shut we may easily discerne that the *Pupilla* of the other will be suddenly dilated, because of the affluence of the spirits. And by this demonstration *Galen* in the fourth Chapter of his seventh booke *De placitis*, maketh it manifest euen to the very sense, that there is not onely a spirit, but an Animall spirit in the body of man.

Their membranes.

If it be demanded why Nature did so prouide, that when one eye is shut, the spirits should all accrew to the other: I answer, it was to accomplish the perfection of that sense; for the concurrence of spirits doe better receiue the impression of the obiect and conuay it to the sense with more speed and certainty.

Concerning the counsell of Nature in vniting the Opticke Nerves, many men haue disputed diuersly. *Galen* thought it was, that one obiect might not appeare double, which conceite *Vesalius* dislikes, and so doth *Archangelus*, who addeth, that if that had beene the reason, the Nerves of Hearing, of Smelling, and of the rest of the Senses should haue beene vnited in the middle of their iourney, that one audible or odorable thing might not appeare double.

Diuers reasons why the optickes are vnited. Answered.

The second reason giuen for the vnition of the Opticks, is, that one eye being put out, the creature might see with the other; but it is more reasonable to say that Natures first intention was, that both the eyes should alwayes remaine sound.

The third reason is, that when one Eye is shut, all the visive spirits should hasten vnto the other to make the sight more acute or sharpe. But it may be answered that one Nerue cannot containe so much spirits as was in both. He that shootes at a marke in a Crosse-bow, or in a Peece, thinkes haply that he sees more sharply when he blinks of one eye then when he seeth his marke with both, but therein he is deceiued, for indeed he seeth not his marke so well, yet is able to lay his leuell better, because he seeth more directly when hee lookes through a narrow hole.

The fourth reason some conceiue to be, that when we are constrained to looke through a narrow hole, or by the same right line, by which both the eyes cannot discerne; in such a case the sight of both eyes might be vnited into one: But I doe not thinke (saith *Archangelus*) that Nature had any such scope in her first intention.

The fift and last reason giuen of the vnition, is the most probable, and that is, that these soft nerves might not be put to distresse in the middle of their passage, where (to say the truth) they are in most danger, as well because of their notable cavities, as also because of their softnesse, for they walke through the moister part of the braine, that is, the lower; and the faculty of seeing requires such a softnesse. Thus farre *Archangelus*.

The most probable of *Archangelus*.

They are called Opticke Nerves, that is, visive from their action, because they communicate the visive faculty or the sense of Seeing vnto the Eye. They are called also by *Herophilus* *meatus visorij*, because (saith he) they onely are sensibly bored, which also *Galen* approueth, who saith that they are manifestly perforated at each end. Many Dissectors are able to perceiue their perforation in the lower part where they touch the Eyes; but saith *Galen* in the fourth chapter of the 7 booke *De placitis*, he that would discerne the other perforation that is at their originall, must obserue three things. First, that the creature which he dissects be great: secondly, that the dissection bee made presently after death.

The names of the optickes.

Their perforations.

Whether the
Opticks be
perforated.
Opinions of
Anatomists.

death. Thirdly, that the ayre be cleare and lucide where he makes his dissection. He addeth also in the same place a reason why it was necessary that these nerves should rather be perforated then any other, and that is because these nerves do leade along the animall faculty by animall spirits or by a spirituall substance. For the rest they needed onely be porous without any hole or perforation, because the faculty in them is conuayed not by animall spirits but onely by a beaming irradiation. But the latter Anatomists with one consent do deny any such conspicuous perforation. *Vesalius*, I neuer met with it although I have cut vp dogs aliue and other large creatures only for this purpose, yea saith he I have opened the head of a man within lesse then a quarter of an houre after it was cut off, and haue carefully kept it warme with hot water, and yet could neuer find any such perforation. *Falopius* in his obseruations, The optickes are not manifestly perforated. *Columbus*, No pore or hole may be scene in them neither in an Oxe nor any greater creature. *Laurentius*, I neuer obserued any conspicuous cavity. *Volcher*, The opticke nerue is not made of a solid and perforated body, but of many nervous fibres bound and vnited by Membranes.

Questions
concerning
the spirits in
the nerves.

Thus you see that the streame of Anatomists runs directly against this opinion of *Galen*, and they render a reason, for say they, their substance being rare and soft, the spirit may easily passe through them vnto the eyes: yea all the sinewes although they haue no visible holes yet are they full of spirits, for the sense is hindred both by compression and by obstruction. So if a nerue be intercepted with a band or tye, the part below looseth sense, for the spirits of the vpper part being separated from the lower, there is no communion between them, but if the tye be taken away the sense returneth. And hence it is, that when the opticks are obstructed in that disease which the Arabians call *Gutta serena*, the action of seeing is vtterly taken away.

But whether wee are to belecue that in euery nerue there is a spirit as there is a spirit in the braine, which being perished the whole creature becommeth stupid, and being strong or plentiful serueth for the sense and motion of the parts; and whether if there be any such spirits they be inbred and seated in the nerue of the part, and onely awaked by a message from the braine, or whether at such time as we would moue any member, the motiue spirit falleth from the braine into the nerue, we confesse with *Galen* in the place before quoted, that we are not able absolutely to determine.

Bauhine des
termination.

Bauhine concludeth that these Nerves are not onely thicke and of a rare texture inuested by both the membranes of the braine, and fit to giue way for the transportation of the spirits, but also saith he, we belecue with *Galen* that they are porous as will especially appeare if they bee sodden, and *Archangelus* saith, that in the coition of the opticke nerves there is a common cavity insculped out of one into another. We say also with *Galen* in the eight chapter of his ninth booke *de vsu partium*, that the opticks in dignity are preferred worthily before the moouing Nerves of the eyes, because the principall part of vision or sight consisteth in them.

Moreouer saith *Bauhine* whilest they are yet in the Scull, certaine branches of the sleepe arteries do on either side touch them, which obseruation he tooke out of *Galen* in the place before quoted.

The vse of the
opticks.

The vse of the opticke nerves is one and the same according to all Anatomists, who herein do accord with *Galen*, that through them the sensatiue soule and the visive spirits are conuayed out of the marrow of the braine into the eyes.

The second
coniugation
of the eye-
mouers, their
originall.

The second coniugation of the braine is of the Nerves that mooue the eyes [Tab. 22, fig. 1 and 2, K] distinguished from the former coniugation onely by a thin bone. This coniugation is small and fine, much lesse then the former, and harder because it is to be inserted into muscles. It ariseth out of the basis of the marrow of the braine, and so runneth forward vnto the cavity of the eye, where it falleth out of the Scull through a proper hole accounted for the second perforation of the wedge bone.

Where they
passe the skull.

This hole is not round, as that which was bored for the optickes, but somewhat long, saith *Galen* in the eight chapter of his ninth booke *de vsu partium*, because three nerves were to passe through it: This, the third coniugation or the second branch of the third paire commonly so called; and the eight coniugation or the lesser roote of the fift paire, and therefore *Columbus* and *Archangelus* call it *Fissuram orbita*, a cleft or chinke of the Orbe of the eye.

The diuision
of this paire.

This moouing Nerue hauing perforated the bone, is fastned to the Opticke, and diuided into good large branches which are conuayed to the seuen muscles of the eye, saith *Vesalius* and *Platerus* to fve muscles of the eye, and to two of the eye-lid saith *Columbus* and *Archangelus*.



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The fourth

gelus; to foure onely of the eye; and that that lifteth vp the eye lid, saith *Falopius* and *Laurentius*.

Bauhine particularizeth concerning their insertion on this manner.

The first branch climbeth ouer the Opticke, and is disseminated into the muscle that lifteth vp the eye-lid, and the Muscle that lifteth vp the eye. The second, is very conspicuous vnder the Opticke and is diuided into many surcles and disperfed into the Muscle which leadeth the eye to the inner angle. The third is bifurcated and inserted in many strings into that Muscle which draweth the eye directly downward. The fourth is conuayed into the sixt Muscle which leadeth the eye round; or rowleth it vnto the vtter Angle.

There are also saith *Falopius*, and with him *Laurentius* and *Bauhine*, certaine small and threddy Fibres, which accompanying the Opticke Nerue are disseminated into the externall Membranes of the eye. In some men, through it be not very ordinary saith *Columbus* and *Archangelus* (but *Falopius* and *Laurentius* deny it) some branches are sent from this second Coniugation to the temporall muscle, whence it is that when that muscle is offended the eye partaketh with it, and on the contrary.

A consent be-
twixt the 2
coniugation
and the tem-
porall muscle.

The vse of this Coniugation is to conferre the Moouing faculty vnto the muscles and the tactiue faculty vnto the membrans of the eyes. Now the reason why when one eye is moued to one side, the other eye also followeth his motion necessarily, is to be ascribed to the Nerues themselues, which in their originall are continuall, that is, doe immediately ioyne together. And so much of the first and second Coniugations which are the Opticke and moouing Nerues of the eyes. Now we proceed.

The vse.

CHAP. XXIII.

Of the third and fourth Coniugations of the Braine.



THE third Coniugation [*tab. 22, fig. 1 and 2 L*] is sent vnto the muscles of the face and is commonly called the lesser roote of the third paire. But, saith *Bauhine*, because it is neuer ioyned with the Coniugation following [*ta. 22, fig. 1 and 2 L with M*] neither in the beginning nor in the progresse nor hath any thing common therewith, and because it groweth out of order in respect of all the rest, therefore saith he, it may worthily be called a peculiar Coniugation. It is saide to arise from that side of the basis of the Braine where the spinall marrow takes his originall. [*tab. 22, fig. 1 D*] But *Falopius* in his Obseruations hath it thus and better. It ariseth from the lower and backward part of the marrow of the Braine, or those processes thereof which are called the *Buttocks*. *Bauhine* addeth, that their originall is very small, and runneth directly vnder the basis of the braine to the side outward, and perforateth alone the *Dura meninx* on either hand. Then being fastned to the second paire [*tab. 22, fig. 1 K*] it entreteth into the orbe of the eye together with it by a perforation common to them both. And is diuided into foure branches according to *Vesalius*, *Columbus*, *Platerus* and *Bauhine*. But *Falopius* ascribeth these branches to the two subsequest coniugations which we haue reckoned but for one.

The 3 coniugation.

His originall.

Diuisiō.

The first of these [*tab. 22, fig. 2, N*] runneth vpward thorough the fat of the eyes and affoordeth a branch to the fist muscle placed in the inner angle (which compasseth it) vnto the pulley. *Falopius* is of opinion in his Obseruations that this whole Coniugation is bestowed vpon this muscle. But presently after the branch we made mention of before is bestowed, it falleth through a peculiar hole of the forehead bone to the skin of the forehead to giue it and the vpper eye-lid motion.

The second branch of this coniugation [*tab. 22, fig. 2 O*] is lower then the former and running downward passeth through a proper hole grauen for him in the fourth bone of the Iaw, at whose forepart it is diuided into many propagations distributed into the muscles that moue the vpper lippe and the Wing of the nose; outward into the lip it selfe, and the gums of those teeth that are called *Incisori* or the *shredders*.

The third branch [*table 22, fig. 2 P*] issuing through the second hole of the vpper iawe, behind the Caruncle seated in the angle of the eye, attaineth the eavity of the nosethrills where it is consumed into the coat, [*table 22, fig. 2 the lower P*] and affordeth a branch to the Membranous muscle of the nose which contracteth the wing thereof.

The fourth branch [*Table 22, figure 2 Q*] passing through the fissure which is betwixt the

bone

Table 22. Figure 1. sheweth the basis of the Braine, and After-braine, freed from their Membrane, that the originall of the Nerves of the Braine might be better perceived.

Figure 2. sheweth one side of the Braine, the After-braine, the spinal marrow, and the Nerves.

TABVLA XXII.

FIG. I.

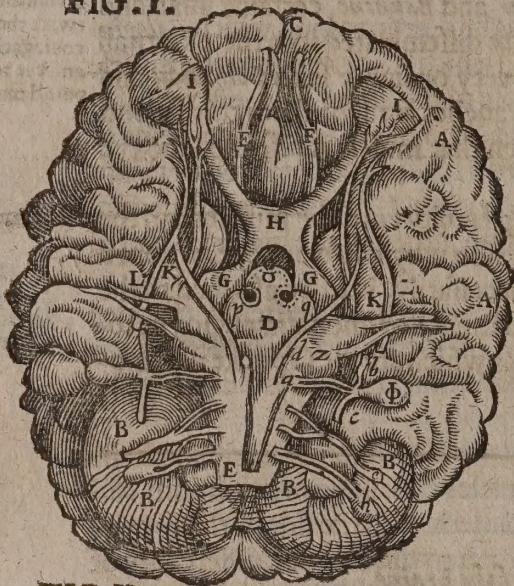


FIG. II.



G G, 1, 2. The Opticke Nerves.

H, 1. The coition or vnion of the Nerves.

II, 1, 2. The coate of the eye wherinto the Opticke Nerue is extended.

K K, 1, 2. the second paire of sinewes ordained for the motion of the eyes.

L L, 1, 2. the third paire of sinewes, or according to most Anatomists the lesser root of the third paire.

M M, 1, 2. the fourth paire of sinewes, or the greater root of the third paire.

N, 2. A branch of the third coniugation deriued to the musculous skin of the forehead.

O, 2. A branch of the same to the vpper iaw.

P P, 2. another into the coate of the nosethrills.

Q, 2. Another into the temporall muscle.

R, 2. A branch of the fourth coniugation crumpled like the tendrill of a Vine.

S, 2. A branch of the same reaching vnto the vpper teeth and the gummies.

T, 2. Another of the same to the lower iaw.

V, 2. a surcle of the branch T, to the lower lip.

XX, 2. other surcles from the branch T, to the roots of the lower teeth.

Y Y, 2. the assumption of the nerue of the fourth coniugation vnto the coate of the tongue.

Z, 1, 2. the fourth paire vulgarly so called which are spent into the coate of the pallat.

a, 1, 2. The fift paire of sinewes which belong vnto the hearing.

φ The Auditory Nerue spred abroad into the cavity of the stony-bone.

* A hard part of the fift coniugation about the * which may be accounted for a distinct Nerue.

b 1, 2. A small branch deriued from this harder part of the fift paire.

c 1, 2. A lower branch from the same originall.

d 1, 2. this Nerue is commonly ascribed to the fift paire, but indeed is a distinct coniugation which we will call the eight, because we would not corrupt the order of other mens accounts.

e 1, 2. The sixt paire of sinewes.

f 2, a branch from them deriued to the necke, and the muscles couched thereupon.

g 2. another branch to the muscles of the Larynx or thortle. h, 1, 2. the seuenth paire of sinewes.

i 1, the vnion of the seuenth paire with the sixt.

l 2, a propagation of the seuenth paire to those muscles which arise from the appendix called Styloides.

m 2. Surcles from the seuenth coniugation to the muscles of the tongue, the bone Hyois and the Larynx.

bone of the vpper iaw and the wedge-bone is consumed into the temporall muscle. And thus much of the third coniugation.

The fourth Coniugation.

The fourth coniugation belongeth to the tongue, and are called *Nervi gustatorij*, because by them the sense of gustation or tasting is made. [t. 22. fi. 2. M] This coniugation lieth close to the former in the progresse, but not in the originall, and is called by them that thinke it hath his beginning from a double root, it is called, I say, the thicker roote of the third coniugation. It doth not proceed, saith *Galen*, in the eighth chapter of his ninth booke *De vsu part.* out of the backe parts of the Braine, because those are hard, nor out of the sides, because the way had not been safe; but out of the basis of the Braine, where the fore-part is tyed to the hind-part, yea, out of the marrow of the Braine. And the reason of this originall is double: first, because it was most secure, and againe, because it was the readiest to answer the position of the tongue; from thence it falleth directly downward thorough the sixth hole of the wedge-bone, which is common to this and the following Coniugation, [Tab. 22. fig. 2. z.] and from this presently after the out-gate issueth a propagati-

His Originall.

CHAP. 24.
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Styloides vnto
the fourth coni

on twisted or wrethed like the tendrils of a Veine, [tab. 22, fig. 2, R] that so, say some, it might by degrees become harder; or rather that the Animall spirit might haue a little stop or stay; and is vnited by two branches [Tab. 22, fig. 1, and 2, b c] with the auditory nerue. Sogiuing furcles to the muscles of the face, to the temporall muscles, to the grinding muscles of the cheekes and to the skinn of the face.

When it hath allowed this wrinkled branch, it descendeth more downward and fendeth forth a shoote [Tab. 22, fig. 2 s] which affoordeth furcles forward to the gums of the grinding teeth, and to the teeth themselues in their order, yet some doubt whether they passe as farre as the rootes of the teeth.

At the same time also there buddeth out of the backside a third propagation which *Falopius* calleth the fourth nerue of the third payre, [tab. 22, fig. 2, T] which is inserted into the muscle that lurketh in the mouth, and passing through the inner hole of the lower law offereth furcles to the roers of the lower teeth of his owne side, [tab. 22, fig. 2, x x] and by the helpe of these nerues the teeth (whereas other bones haue no sense) do feeble the occurrance of things that are offensiue. The remainder of this coniugation [ta. 22, fig. 2, V] neare the skinn, issu- ing through a hole bored in the foreside of the law is communicated to the lower lip and to the skin thereof in many furcles.

The remain-
der.

From this nerue also before it get into the law, there ariseth often a small sinew, slender indeed but strong and long which runneth vnder the law till it come to the muscle which openeth the mouth, and to those which are placed vnder the Chin, and is inserted partly in- to the bone Hyois and partly into the tongue.

Finally, the trunk of it selfe [tab. 21, fig. 2 T] which *Falopius* in his Observations calleth the fift nerue of the third coniugation, passeth through the muscles that lurke in the mouth, and being accompanied with the trunk of the other hand passeth vnto the side of the tongue and is consumed into the coate thereof to make it a fit organ to discern the differences of sapor or Tastes, and from it certaine small furcles are fixed into the substance of the tongue.

From this coniugation that which is commonly numbred for the fourth, by *Galen*, *Vesali- us*, *Columbus*, *Platerus*, and *Laurentius* [tab. 2, fig. 1, and 2, Z] seemeth not to be distinguished; not because it is nearest to that before named, but because it taketh his originall (though his furcles be many) out of one place, and in one place onely perforateth the *Dura meninx*. For those paires or coniugations which are commonly numbred for the sixt and the seauenth al- though they arise from many propagations, yet because the furcles are vnited together and so vnited do fall through one perforation of the *Dura meninx*, are not accounted for double or manifold paires, for we thinke with *Falopius* that in the distinguishing of the coniugations of the nerues the holes of the Scul are not to be considered; for if this were to be obserued, then because the second and the third paires and the eight do passe through one and the same hole they should be accounted all for one coniugation, which were yet neuer so accounted by any Anatomist.

How to count
the coniugati-
ons of the fi-
newes.

The originall of this nerue is lesser then the former, neare vnto it and a little harder, and therefore *Galen* saith, that it springeth more out of the Basis of the braine as from a part there- of which is the harder.

The originall
of it.

Presently after the originall, it passeth a little forward and is mingled with the third, with which it issueth at a common hole, and at the pallate is diuided into diuers branches, into whose whole coate it is inserted, [table 22, fig. 2 the lower Z] and giueth vnto it the sense of Tasting. *Galen* saith it is somewhat hard because the coate which compasseth the mouth is harder then the tongue and other parts of the mouth; and in this respect his sense is the duller. Sometime two small branches, which descend neare the Almonds and the Appendix called *Styloides* vnto the roote of the tongue are distributed through his coate. And thus much of the fourth coniugation.

CHAP. XXIII.

Of the Auditory Nerue or the fift Coniugation.



THE fift Coniugation [Tab. 22, fig. 1, and 2, a] at the sides of the basis of the braine according to *Galen*, ariseth out of the marrow of the braine elongated, and is made of two furcles or nerues. The one softer (and indeed the softest except the opticks) and nearest to the Eare, the other harder. These two do together issue through the membrane and run into the stony-bone, & many thinke

The fift co-
iugation.

thinke they are ioyned, accounting them for one nerue, for they say the fift Coniugation consisteth of a soft and a hard part, but indeed and truth they are distinguished. [ta. 22 fig. 2. It appeareth under a] which also *Galen* and *Falopius* did obserue.

His double
originall.

His out-gate.

Progress.

This Nerue therefore runneth through a large but writhen hole in the stony-bone, appointed properly for it, which is numbred for the fift perforation of the Temple-bone into the cavity which is like a Cony-burrough prepared for the organ of Hearing. Presently after, the harder part runneth forward through a proper Canale or Pipe, being accompanied with an artery arising from that artery which is disseminated through the *dura meninx*, and through the same bone it returneth obliquely backward, and falleth into that cavity wherein the *Timpanum* or Drum is, yet so that it alwayes butts vpon his owne bony Canale: from thence being more reflected it sendeth forth two shoots, one aboue and another below, both which do passe through by their proper holes. The vpper [ta. 22, fig. 1, and 2 b] runneth ouerthwart through the hole, through which likewise a small veine passeth vnto the Organ of Hearing. And this shoote is mixed [ta. 22, fig. 2 R] with that branch of the fourth paire, or of the third according to common Anatomists, which we said was like the tendrill of a vine: but the lower [tab. 22, fig. 2, c] passeth out at a hole which is very streight and writhen, and being carried ouerthwart over the *masseter* muscle, is instantly mixed with the branch of the third payre that is like the tendril of a vine, or to the propagation of the sinew that goeth vnto the tongue, and from the Tongue is led along to the muscles of the Cheekes, and to the skin about the roote of the outward eare; and haply this Nerue assisteth the Taft as well as the Hearing, and the reason may hence be deriued why those that are borne deafe are also borne dumbe. Sometime when this Nerue hath gottē through the blind hole it runneth downward as if it would accompany the sixt coniugation, [ta. 21, fig. 1 and 2, e] and sendeth small branches to the proper muscles of the *Larinx*, whence it is that because of the consent betwixt the Eares, the Tongue and the *Larinx*, a dry cough ariseth if we picke our Eares too deep. Sometime also it sendeth small branches into the whole arme, with the fourth, fift and sixt nerues of the arme, yea oftentimes it accompanieth the spinall marrow, and sendeth his branches together with the nerues of the marrow into the whole hand. But the soft part of this nerue [ta. 22, fig. 2 a] which is indeed *Nervus auditorius* the true Auditory Nerue, accompanieth the hard part, and when it hath attained vnto the end of the forenamed cavity it is dilated after the manner of a membrane and [ta. 22 fig. 1 and 2, d] becommeth the chiefe instrument of Hearing, and there remaineth after the same manner that we mentioned before in the expansion of the Organ of Smelling.

His branches
vnto the
ioyns.

The true au-
ditory nerue.

CHAP. XXV.

Of the sixt, seuenth and eight Coniugations.

The sixt con-
iugation.



THE sixt Coniugation [ta. 22, fig. 2 e] taketh his beginning from a few fibres a little below the originall of the fift payre or of the Auditory Nerue. But these fibres are presently and mutually vnited, and are thought to make one great nerue, whereas indeed they are not so vnited but that they remaine a good while two distinct nerues contained in one membrane which was the cause of the error. They get out of the Scull at the second hole of the Nowle-bone by which the greater branch of the internal *Iugular* veine did ascend into the braine. The one of these Nerues is the *anterior* and the lesse, the other is the *posterior* or the greater. The lesse when it hath gotten out of the Scull descendeth directly vnto the muscles of the Tongue (to whose roote it affoordeth a branch) and to those muscles which occupy the *Fauces* or chops, and into them most part of it is consumed.

His egress.

The greater Nerue not farre from his egress sendeth a branch backward, [tab. 22, fig. 2, f] which is distributed with many furcles into the muscles that occupy the necke, especially into the Cowle muscle which is the second of the shoulder-blade.

His descending
trunke.

The Trunke it selfe descending is connected or tyed to the seuenth Coniugation, [tab. 22, fig. 2, H] to the Sleepy artery and to the internal *Iugular* veine, by the interuening or interposition of a membrane, and at the sides of the *Larinx* or Throttle it is increased by a branch from the seuenth Coniugation [table 22, fig. 2, i] with which branch notwithstanding it is not mixed (for *Platerus* in this mixtion mist his marke) but colligated or tyed thereto. Presently after it sendeth furcles ouerthwart [tab. 22, fig. 2, g] vnto the muscles of the *Larinx*, especially those on the inside thereof. It affoordeth also a few small branches distinct from the former to the muscles of the *Fauces* or chops. From thence it descendeth

vnto

vnto the Chest and runneth quite through his capacity, as also thorough the capacity of the lower belly, and distributeth many branches vnto the bowels of both bellies, as we haue partly declared already and shall do hereafter towards the end of this booke. And because it runneth almost through all the bowels of the body, it is therefore called *Coniugatio vaga*, the gadding or wandering coniugation.

Falopius tells vs, that the Membrane wherewith this sixth nerue is inuested, as it falleth through the perforation assumeth vnto it selfe sometime manifestly, sometime secretly, a few small and capillary fibres of the nerue, and when it is out of the scull, produceth a certaine long body resembling an Oliue, which is sometimes single, sometimes double in both sides, and the colour fleshy, although the substance be neruous and hard.

Falopius his conceit of the Oliue-like bodies.

This *Oliue-like body* endeth into a certaine neruous fibre, which falling downe the necke, together with some propagations of nerues coupled together which issue from the first and second, and fourth and fift and sixt, or from the first and second, and fift and sixt and seuenth paires of the necke, doth make a texture or complication of vessells like a little net which descendeth on either hand downe the forepart of the whole necke; and in that complication, saith he, other new Oliue-like bodies do sometimes grow together, whose number is vncertaine, consisting of no other substance but as it were a heape of nerues growing together into a callous or fast body like a scarre. And this coniunction of nerues he calleth *sexti paris plexum*, the texture or complication of the sixth coniugation; from which texture many nerues, saith he, do descend vnto the basis of the heart. Herefrom also very often doth a nerue take his originall which on both sides is conueyed vnto the midriff, although it receiueth a further increment or encrease from the fourth and fift coniugations of the necke. He affirmeth further, that from this complication there issueth a nerue which descending through the chest along the roots of the ribs is conueyed to the roots of the Mesentery. Thus farre *Falopius*.

Now that from this sixth coniugation, nerues are sent vnto the bowells and not from the marrow contained in the rack-bones this reason may be giuen, because hauing not voluntary motion they did not stand in neede of so hard Nerues as do arise out of the spinall marrow properly so called; yet that they might not be altogether without Sense, they receiue Nerues of Sense, that is, soft nerues issuing out of the marrow of the Braine whilst it is yet contained in the scull, and the rather, saith *Galen* in the 11 chap. of his ninth Booke *de vsu partium*, because the substance it selfe of the bowels is but soft; but because these Nerues were to go a long journey, least they should be offended they are inuested with strong membranes, and besides fastned to the bodies by which they passe.

Why the bowelles haue nerues from this coniugation, and not from the spinall marrow?

It is also worth the obseruation that the nerues which are disseminated from the sixth coniugation into the trunke of the body, are as large almost at their terminations after they haue bene diuersly diuided and subdiuided as they are in the original, which cannot be said of any other vessell. It hath bene also publickly deliuered, I thinke from no other warrant but speculative Learning, that this nerue descendeth into the ioynts, and in the seete is the cause of the great consent betwixt the feet and the head. For mine owne part, I could neuer haue light of any such diuarcations out of Classicke Anatomists: beside, what neede we search for an imaginary way of consent, when we know that which is direct and agreed vpon by all, which is the branches of the nerues of the spinall marrow, wonderfully vnting themselves in the Tendons of the Muscles of the foote; by which any annoyance may at the first hand be conueyed vnto the marrow of the backe and so vnto the Braine.

A notable obseruation.

Moreouer, *Galen*s reason of the allowance of these Nerues of the sixth coniugation to the bowels in the place last before quoted were but of small moment if the feet also had nerues deriued therefrom. But this onely by the way.

A notuall conceire.

The seuenth coniugation, which *Archangelus* accounteth for the eighth, because he maketh the organs of smelling a coniugation of nerues: the seuenth coniugation I say [tab. 22. fig. 1 b, fig. 2 H] moueth the tongue and is the hardest of all those that yssue out of the Braine within the scull, and indeed it taketh his originall from a harder beginning, that is to say, in the hind-part of the Nowle-bone where the marrow of the Braine endeth saith *Galen* in the twelfth of his ninth Booke *de vsu partium*. From the beginning of the spinall marrow, saith *Vesalius*, but before it yssue out of the scull. From the Braine, not from the After-braine, saith *Columbus*. *Archangelus* saith from the backpart of the marrow where the cavity is that is compared to a writing pen. From the the marrow of the Braine, saith *Bauhine*, when it is ready to fall out of the scull [tab. 22. fig. 1 and 2 E] that is to say, at the very beginning of the spinall marrow properly so called. Thence therefore it ariseth with more roots then one, and those some-

The sixth coniugation.

His originall.

what

what distant one from another. But they vnite themselues and passe out of the scull by an oblique and proper perforation in the Nowle-bone, and for more security this Coniugation (saith *Galen* in the eleuenth of the ninth *de usu partium*) is ioyned by strong membranes with the sixt coniuigation, but not commixed therewith, saith *Falopius* in his Obseruations. For Retribution it communicateth to the sixt paire a portion of it selfe, [tab. 22. fig. 2 m] that is to say, sometimes one fibre or string and sometimes two, but the coniuigation it selfe keepeth still his owne body, and with a round and full thred runneth downward vnto the tongue, whose roote when it attaineth the greater part thereof [14. 22. fig. 22] is dissolued or as it were vntwisted and parted into many fibres, which as so many surcles are imparted into all the muscles of the tongue.

His implanta-
tion.

The lesser part sendeth some branches vnto the muscles of the bone *Hyois* and the Throttle to assist their motion. It affordeth also some surcles [tab. 22. fig. 2 l] vnto the muscles which take their originall from the appendix which is called *Styloides*. Finally, the fibres of the greater branch doe seeme to be commixed with the fibres of the fift coniuigation.

The eight
Coniugation.

The eight coniuigation (if we may so call them, which others do ascribe vnto the fift) [tab. 22. fig. 1 and 2 d] issueth out of the marrow of the Braine about the Auditory nerue, (and is much slenderer and harder then it) betwixt the second and third coniuigations. It runneth vpward & forward vnder the fibres of the basis of the Braine, and hauing perforated the *Dura meninx* betwixt the second and third coniuigations, it getteth into the orbe of the eye through the hole of the second coniuigation, saith *Banbinc*, according to *Falopius*, although *Vesalius* and *Platerus* thinke it passeth through a proper perforation in the wedge-bone, and so goeth vnto the temporall muscle and that which lurketh in the mouth; but the truth is, that it is almost wholly consumed in the muscle of the eye which draweth it to the viter angle.

Implantation.

This coniuigation, saith *Banbinc*, in regard of his originall should haue bene accounted before the fift and those that follow, but least in changing the number resolved vpon by Anatomists we should breed confusion, we haue rather thought good to reckon it in the last place. *Columbus* addeth a ninth paire, of which he challengeth the inuention, and for ought I know no man is desirous to take that prize out of his hand, which when they haue they shall not be able to hold; but he saith, that they be very small nerues arising from the two processes of the Braine, which are called *Nates* or the *Buttocks*, neere the Testicles; they bend their course toward the face, and passe out by the third and fourth coniuigations and are inserted into the third muscle of the eye-lid, but allow a branch also to the fift muscle of the eye. Thus farre *Columbus*.

Columbus his
ninth coniu-
igation.

And so much concerning the coniuigations of nerues seuen, or eight if you will, or nine if you beleue *Columbus*, which yssue from the marrow of the Braine contained yet within the Scull. Now we proceed vnto those that issue from the spinall marrow when it isalne out of the Scull.

CHAP. XXVI.

Of the Nerues which issue from the spinall Marrow in the Necke.



THE coniuigations before mentioned are called *productions* of the Brain, and *nerues* of the Braine, albeit they issue from the lengthened Marrow thereof, but yet contained within the Scull. Now we come vnto those sinewes which draw their originall from the same marrow indeed, but that contained in the rack-bones of the spine, and therefore are called *Nerues of the Spinall marrow*. For from this marrow all the parts which are vnder the face, excepting the bowels and the instruments of the voyce, do receiue Nerues; the bowels and the instruments of the voyce do not, partly because it was necessary that some of them should be immediately ioyned with the Braine, as the Heart and the Liuer, (for it behooued that all the principles of those faculties whereby the creature is gouerned should be conioyned) partly because their situation is neere vnto the Braine, and they stand in neede onely of Sense.

The Nerues of the spinall Marrow are accounted thirty Coniuigations yssuing out of distinct parts and seates, as out of the marrow of the Necke, the Chest, the Loynes, and the Holy bone contained within their *vertebra* or racke-bones, and out of their perforations

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forations or the holes thrilled in them. These holes are either double, before and behind as in the two first of the necke and five of the Holy-bone, or single in each side of the racks, as in the rest.

The coniugations of the necke some account seven, as *Galen*, *Vesalius*, *Platerus*, and *Laurentius*, yet *Galen* in the first of the 13 *de usu partium* reckons 8, and so doth *Archangelus*; *Columbus* but five. These are dispersed into the outside of the whole head and his Muscles.

The first and second coniugation do not arise after the manner of other Nerues out of the sides of the spondels, one out of the right side, the other out of the left; but one falleth through the hole on the fore side, the other through the hole on the back side, which happeneth because of the different articulation of these two racks which is so made for the more security of the motion.

The first Coniugation issueth betweene the Nowle and the first racke-bone, which that it might more easily be, there is a certaine small cavity in the nowle-bone and in the first vertebra, (yet in dogs in whom the spondell is greater, the cavity is onely in it) but before it issue it is reflected about the spinall marrow and presently is diuided into two small branches, one anterior which is very small, [Tab. 23 H,] and so small that *Vesalius* saith it is not alwayes visible, but *Columbus* maketh no mention of it at all.

This nerue is inserted into the muscles which lye vpon the necke and vnder the gullet, which bend the necke, accounted by *Vesalius* and *Platerus* for the first payre that moue the backe, but *Bauhine* reckoneth it for the first bender of the necke, and calleth it *Longus* or the *Long-muscle*.

Table 23 is the same with Table 22. Lib. 7.

The other posterior [tab. 24, F] which is subdiuided into a double surcle, one lesser which is disseminated into the small muscles of the head seated in the *Occipitium* or nowle, the right branch into the muscles on the right side, and the left into the muscles of the left side, which also we must vnderstand of the nerues that follow. The other surcle of the posterior branch [tab. 24, e] goeth into the beginning of the muscle that draweth the shoulder blade vpward, for being but small they do not run beyond the muscles.

The second coniugation issueth with two beginnings, the fore branch [tab. 23, N] is very small and slippeth out betwixt the first and the second rack-bone at the sides of the tooth of the racke, and is distributed into the muscles that sit vpon the necke, as that branch of the first coniugation is of which wee spake ere while, with which branch it is implicated, and so consumed into the whole skin almost of the face.

The posterior branch which is the greater [table 24, I] when it is yssued by the side of the backward prolesse of the second racke-bone is presently diuided into two vnequall branches: the thicker [table 24, K] runneth ouerthwart toward the middle of the spine where the muscles do meete that occupy the necke, and is increased with a surcle [table 24, L] of the third coniugation, [table 23, S] and from the back-part tendeth vpward vnto the fore-part of the head, and disperfeth propagations into the skinned of the whole head euen to the top of the whole crowne, yea and vnto the eares, [tab. 23, and 24 MM] but the lesser branch [tab. 24, about B] is distributed into the beginnings of the third and sixt paires of muscles of the Head.

The third coniugation [table 23, char. 3,] breaketh out of a common hole which is betwixt the second and third spondell, and is diuided into two branches. The anterior whereof [tab. 23, P] is subdiuided into foure surcles, the first goeth to the first paire of muscles that bend the necke, the second [tab. 23, and 24, R groweth with T] runneth downward, and being commixed with a surcle of the fourth coniugation is distributed into the muscles that lye vnder the Gullet.

The third surcle [tab. 23, and tab. 24, from K to I] runneth vpward and meeteth with a branch of the second coniugation, and is spent into the skin on the sides and top of the head. The fourth [tab. 23, and 24, T] is disperfed into the muscles that incline the necke to the sides, as also vnto the muscle that lifteth vp the bladder. Finally, into that quadrangular muscle arising from the fleshy Membrane which draweth the lip obliquely downeward.

The posterior branch of the third coniugation [table 23, 24, O] is disseminated into the muscles that are common to the head and the necke, and lift it vp which are called *Sacer* and

7 of the necke.

The first.

His diuision.

Subdiuision.

The second
coniugation.
His double
originall.

The third
coniugation.
His diuision,
and subdiuifi-
on.

and *semispinalis*. The first *Vesalius* accounteth for the seventh mouer of the backe, and the second for the eight.

The 4. coniugation.

The fourth Coniugation [*tab. 23 char. 4.*] issueth out of the common hole of the third and 4. Racke bones, and is diuided saith *Columbus* into many furcles. *Bauhine* saith into 2. branches, an *anterior* and a *posterior*: the *anterior* which is the greater is deuided into three propagations. [*tab. 23, and 24, X.*]

Diuisiō.

The first [*tab. 23, r.*] is mixed with a branch of the third paire [*tab. 23, R.*] and goeth to the muscles that lye vnder the Gullet, which make the first paire of Benders of the Necke.

The second [*tab. 23, a.*] departeth into the muscles that bend the necke into the sides, that is, into the second paire and to the second muscle of the shoulder-blade called *Cucullaris* or the Cowle muscle.

The third [*tab. 23, b.*] which is lesser, being accompanied with a branch of the fifth Coniugation [*tab. 23, c.*] and vnited with a propagation of the sixth [*tab. 23, m.*] descendeth neare the *Mediastinum* (where it letteth slip a small branch on each side) and aboue the *Pericardium*; that of these originalles, that is to say, the fourth mixed with the fifth and the sixth, the nerue of the Midriff [*tab. 23, and 24, n.*] might be compounded, which is inserted into his neruous tendon called by others his head. Sometime this branch of the fourth Coniugation is wanting, and then a furcle of the seventh Coniugation supplyeth the place, but howsoeuer, the chiefe part or mountenance of the Nerue is from the fifth Coniugation. The *posterior* branch of the fourth Coniugation which is also the lesse [*tab. 23, and 24, v.*] at the spine of the third Rack-bone bestoweth his blessing vpon the muscles of the necke, which lye vpon that spondell, and from thence is consumed into the membranous muscle of the cheekes.

The 5. coniugation.
His diuision.

The fifth Coniugation [*table 23, char. 3.*] falling out vnder the fourth spondell, is deuided into two branches, one *anterior* another *posterior*. The first furcle [*table 23, a d vnto char. 6.*] of the *anterior* branch [*table 23, and 24 d.*] goeth to the muscles which bend the necke. The second [*table 23, e.*] together with the propagations of the fourth and the sixth Coniugations [*table 23, out of bem.*] maketh the nerue of the Midriff. The third [*tab. 23 and 24, f.*] runneth vnto the muscle called *Deltoid*, which is the second of the arme from which small branches [*tab. 24 TT.*] are afforded to the muscles that lift vp the shoulder-blade called *Cucullaris* and *Leuator*.

From the same furcles also ariseth another Nerue [*table 23, and 24, g.*] which with many smal fibres is implicated in the skin that couereth the *Deltoid*; another lying deepe at the necke of the shoulder-blade is deuided into two branches, the *anterior* [*tab. 23, and 24, b.*] and the smaller affordeth small furcles to the *Deltoid*, where it taketh his original from the clauicle, sometimes also to the skin, accompanying the *humery* veyne.

Table 24. is the same with Tab. 23, Lib. 7.

The *posterior* which is the thicker [*tab. 23. 24, i.*] first sendeth a furcle into the second paire of muscles of the bone *Hyois* called *Coracohyoidei*: afterward being accompanied with a veine and an artery, it sendeth another to the vpper *super scapular* muscle or the vpper Blade-rider, againe vnto the *Deltoid* where it ariseth from the spine of the blade, and finally it sendeth furcles [*tab. 23. 24, n.*] to the outside of the skin of the arme. And so much of the *anterior* branch of the fifth Coniugation. The *posterior* [*tab. 24, e.*] at the tops of the spines is reflected and distributed like the *posterior* branch of the fourth Coniugation.

The sixth coniugation.
His diuision.

The sixth Coniugation which *Columbus* calleth the first paire of sinewes of the hand [*table 23, char. 6.*] vnder the fifth spondell where it issueth, is deuided into an *anterior* and *posterior* branch.

The *anterior* [*table 23, l.*] after it hath ioyned a propagation [*tab. 23, m.*] to the branch of the fifth Coniugation to make the nerue of the Midriff, is vnited with the seventh of the neck and the first Coniugation of the Chest. [*tab. 23, and 24, q.*] Afterward it is diuersly deuided, and with those that follow furnisheth out nerues to be transported to the Arme. It sendeth also a peculiar furcle [*tab. 24, p.*] vnto the hollow part of the shoulder-blade into the muscles that lift it vp.

The *posterior* branch [*tab. 24, k.*] is dispersed after the manner of the rest vnto the muscles which moue the head and the necke, as also into the heads of the muscles which serue for Respiration, which from the necke doe attaine vnto the Chest: those muscles also receiue nerues from the seventh Coniugation and from the first of the chest.

The

The seventh coniugation [*tab. 23. ch. 7.*] issueth vnder the sixt spondell of the necke, and for more security is ioyned with the sixt coniugation of the neck and the first of the chest, [*t. 33. f.*] the chiefe part whereof runneth into the arme, for the nerves of the arme are produced from the fift, sixt and seventh coniugations of the necke, and from the first and second of the chest.

The seventh
coniugation.
His division.

Sometime also there proceedeth from this coniugation a branch to the making of the nerue of the midriffe. Wherefore seeing that from the marrow of the necke many nerves do concur to the making of the midriffe-nerue, it is no wonder that in the Apoplexy the motion of the midriffe is for a while naturall, for although because of the obstruction of the ventricles of the braine, as it is commonly beleued, the animall spirit cannot be conveyed vnto the midriffe, yet seeing that the cavity of the spinall marrow containeth some deale of animall spirits, which by these nerves may be transported vnto the midriffe, and giue it a little motion, thence Respiration remaineth, and though it be but very little, yet the life is thereby sustained as long as the animall spirit shall remaine in the cavity of the spinall marrow, and if the obstruction of the ventricles can be freed, then he that is apoplectically, returneth to himselfe, if not, there he determines his life.

How a man
breathes in an
Apoplexy.

This is *Banbines* physiologie, concerning the apoplexy and the cause thereof, whereto though I can in no sort agree, yet because he handleth it but by the way, and we are now in another argument, I will not reason the case with him.

The posterior branch of the seventh coniugation [*tab. 24. t.*] which is also the lesse, and neuer missing, affordeth furcles to the muscles which lie vpon the necke, and vnto the square muscles of the cheekes; into which also furcles are sent from the fift coniugation of the braine, and from all seven of the necke, excepting onely the first, which furcles run according to the course of the fibres of the muscle: they attaine also vnto the skin. It is no wonder therefore, if the *Dog-spasme* be a grieuous disease, seeing that this muscle in it doth at the first hand suffer convulsion.

The dog-spasme.

Galen in the fift chap. of his 13 booke *de usu partium*, and after him *Archangelus* doe adde an eight coniugation, issuing betwixt the seventh and the eight spondels, and distributed especially into the cubit and the Ell, but passeth no further.

The 8 coniugation
after
Galen and
Vesalius.

CHAP. XXVII.

Of the Nerves of the Chest.



He nerves disseminated through the chest are double as well those that passe through the necke, for some take their originall from the braine, or rather from the marrow therof contained in the scull, others from his marrow passing through the racke-bones of the backe.

Of the nerves
of the Chest.

From the marrow of the braine proceedeth the sixt coniugation of the braine, which runneth through the chest, of which we haue partly spoken before, but will say more afterward in this booke.

From the spinall marrow contained in the back do issue eleuen coniugations saith *Vesalius*, but *Banbines* reckoneth twelue, all which after their egress are diuided into two branches, one greater and another lesse, one running forward and another reflected backward.

Twelue coniugations.

The first coniugation [*tab. 23. ch. 8.*] which *Vesalius* accounteth the eight of the spinall marrow, issueth betwixt the seventh rackebone of the necke, and the first of the chest on either side, and is diuided into two branches, one anterior, and another posterior.

The first coniugation.
His division.

The anterior, which is the greater, after it hath receiued an augmentation [*tab. 23, and 24. x.*] from the seventh coniugation, sometime also from the second of the Chest, and is diuersly commixed with the neighbour sinewes; attaining vnto the arme-pits, distributeth propagations [*tab. 24. aa.*] out of his backside into the hollow part of the blade, and so runneth away into the arme whose distribution we shall meet withall in that place.

Besides this, it sendeth also another branch [*tab. 23. y.*] vnto the arme, which running forward along the first rib, and so to the top of the brest-bone, bestoweth his blessing vpon the first muscle of the chest, called *subclanius*, and then is consumed or spent into the muscles which take their originall from the top of the brest-bone, as the muscle called *Mastoides*, *Sternohyoides*, and *Oesophagii*.

The posterior branch [*tab. 24. u.*] which is the lesser, is reflected vnder the muscles which grow vnder the Rack-bones, and in his transition affordeth small shoots to the second muscle of the necke, and those that moue the necke and the head backward; but when it hath

K k k k

attained

The 2 coniugation.

attained the spine of the seventh Rack-bone it departeth therefrom and offers surcles overthwart to the lower part of the cowle-muscle, the *Rhomboides* & the vpper & backward spine.

The second Coniugation [tab. 24, char. 9,] issueth betwixt the first and second racke of the Chest, and as the former it transmitteth and distributeth a branch backward [tab. 24, B,] afterward a good part is ioyned with a branch of the first coniugation [tab. 24, A] and runneth into the arme. The remainder proceedeth to the length of the first rib vnto the Chest and maketh the *Intercofall* nerue, from which certaine small surcles are distributed vnto the muscles that lye vpon the Chest.

The 3 and the nine following.

Their fore-branches.

The third and the other nine Coniugations [tab. 23 from char. 10, to char. 20,] of the chest are distributed after the same manner; for after they are issued out of the sides of the Racke-bones, they are deuided into two branches. The *anterior* branches which are called the *Intercofall* finewes [tab. 22, m] in their passage doe offer a surcle to the *Costall* nerue, which is said to be a branch of the sixth coniugation of the braine, and runneth vnder the *Pleura* vnto the rootes of the ribs: yea throughout his whole iourney they increase it with a small branch. For the branches themselves runne directly after the bent of the ribs through the distances betwixt them in a proper *sinus* or cavity insculped or grauen in the inner and lower side of euery rib for the transportation of these branches, together with a branch of the veine *Azygos* and the great artery which accompany them; and their course is forward vnto the *Pleura* neare the *Intercofall* muscles: so that the *Intercofall* veines of the true ribbes do reach as farre as to the brest-bone, those of the bastard ribbes do attaine vnto the fore side of the *abdomen* about the *Peritoneum*.

From these, diuers branches [tab. 23, 000 and the characters of the left side] are disseminated into the *Intercofall* muscles as wel internal as external, into the muscles that lie vpon the chest, [table 23, 00 11 xx] as the greater and lesser Saw, the *Pectorall* muscle and that which is called *Latissimus*, [tab. 23, uu] moreover into the oblique descendend muscle of the *Abdomen*, all which branches imitate the fibres of these muscles. They offer also small shootes sprinklingly vnto the skin of the chest.

These Nerves as also the rest, of course should haue beene inserted directly into the heads of the muscles, but nature hath reflected them backward into the veines, arteries and ligaments of that place. From the lower *Intercofall* nerves, some shootes also are communicated [tab. 22, aa] to the muscles of the *abdomen*.

Finally, from that *Intercofall* nerue which creepeth through the fourth distance of the ribs are certaine propagations [tab. 23, v] disseminated into the *Pectorall* muscles, from which there yssue some fine and small shootes vnto the paps giuing them a very exact sense. And so much for the *anterior* branches.

Their hinder-branches.

The *posterior* which are the lesser are reflected backward vnto the spines of the rackbones, and lurke amongst the muscles that grow vnto them, and are appointed to moue the Back and the Chest; yet are they not wholly consumed in these muscles, for when they haue touched the tops of the spines, they fall betweene the congresse or coniunction of the muscles of both sides, and are distributed into the muscles which arise from those heights of the Spines, as those that are called *Splenij*, *Romboides*, *Cucullaris*, *Latissimus*, *Serratus*, *Posticus inferior*, and some are distributed into the skin. But the distribution of Nerves into the skin is not one and the same in all bodies, and therefore can neither their order nor their number be certainly defined, for the trunks are deuided throughout the skin, sometime into more sometime into fewer branches.

To conclude, the two last coniugations of the chest doe offer surcles, *Columbus* saith to the fleshy part of the Midriffe. *Bauhine* [ta. 23, at the sides char. 18, 19] to the head of the muscle called *Lumbalis* or the sixth muscle of the Thigh.

CHAP. XXVIII.

Of the Nerves of the Loines.

The nerves of the loynes. 5 Coniugations.



He common and receiued opinion is, that from the spinall marrow contained in the rack-bones of the Loines doe arise five Coniugations of finewes which are greater then the coniugations of the chest, and issue out of the holes of the rackes of the Loines: herein agreeing with the nerves of the chest, that every coniugation is diuided into an *anterior* and a *posterior* branch, and that from the *posterior* branches [tab. 24, char. 52, 53] propagations are distributed into the muscles that grow vnto the rackes of the Loines. Among themselves they haue this also common saith *Galen*, that they are disseminated into the spinall muscles, the *Abdomen* and the flesh of the Loines.

The

The first coniugation [table 23, char. 20] as also the rest issuing at the holes of the spondyl under the Rim is divided into two branches, one *anterior* and greater, from which surcles are sent into the fleshy parts of the Midriffe, others vnto the head of the Muscle called *Lumbalis*, others vnto the muscles of the *Abdomen*. The *posterior* branch is the lesser and reflected into the muscles which lye vpon the racks of the Loines whereinto it is consumed as are the Surcles of the following coniugations. Such are the muscles called *Sacrilumbus*, *Longissimus* and *Sacer*. But where they issue from the tops of the spines they run into the sides and are disseminated into the skin of the arme and the broad Muscle called *Latissimus*.

The second coniugation [tab. 23, ch. 21] runneth vnder the sixt muscle of the thigh called *Lumbalis* vpon which it bestoweth small branches afterward: arising vp vnto the top of the haunchbone the *posterior* propagation thereof passing the *Abdomen* doth afford Sense and Motion to the first muscle of the thigh which make the buttockes, and to the first extender of the Legge called *Membranofus*. But the *anterior* branch is distributed into the seventh muscle of the thigh according to *Vesalius* and *Falopius*, but the sixt according to *Bauhine* and *Columbus* called *Iliacus internus*; into the first bender of the legge and vnto the skin of the thigh. From this coniugation also yssueth a small and long Nerue, [ta. 23, ch. 49] which together with the spermatieall vessels of his owne side is conuayed vnto the Testicles, which Testicles also receiue surcles from the *Costal* or rib-branch of the first coniugation of the Braine.

The third coniugation [tab. 23, ch. 22] issueth also vnder the *Lumbal* Muscle. His *anterior* branch passeth neere the haunch-bone and is divided into two propagations; One of which goeth vnto the knee and the skin thereof, the other accompanieth the veine called *Saphena*. But the *posterior* branch is reflected and disseminated into the Muscles that lye vpon the Loines and into the skin. In like manner from the *anterior* branches of the three first coniugations certaine surcles [ta. 23 at the sides, char. 20, 21, 22] apply themselves vnto the costall nerue and are ioyned therewith.

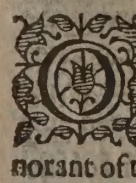
The fourth coniugation [ta. 23, ch. 23] which is the greatest of al the paires of the Loines, runneth vnder the *Lumbal*-muscle and the share-bone accompanying the veine and artery vnto the groine. *Columbus* obserueth, that it sendeth some propagations into the cod and the skin of the yard: but we, saith *Bauhine*, haue obserued that those partes do receiue small sinewes from the marrow of the holy-bone as *Galen* noted in his seuenteenth Booke *de dissectione Musculorum*, and after him *Archangelus*. It distributeth also other propagations, *Columbus* reckoneth seuen, vnto the *anterior* muscles of the thigh and legge, from which some surcles do descend as farre as to the knee.

The fift coniugation [tab. 23, ch. 24] like the rest is divided into two. The *anterior* and greater branch passeth through a hole betwixt the bone of the *Coxendix*, of the share and of the hanches, and distributeth propagations sometimes to both the muscles that compasse or bend the Thigh about; sometimes vnto the seventh and eight benders of the Thigh, sometimes vnto the muscles of the yard, though commonly they receiue nerves from the marrow of the Holy-bone. Item, branches vnto the necke of the bladder and of the wombe which also receiued nerves from the marrow of the Holy-bone. But the *posterior* branch is reflected and consumed into the muscles that sit vpon the racks of the Loines and into the skin of that place. Finally, from the three lower coniugations no small number of branches do reach vnto the Leg, as in that place we shall not forget to remember.

Moreover, these coniugations are hard and fastned one with another, the first with the second, the second with the third, the third with the fourth, the fourth with the fift, as it is demonstrated in the first figure of the 23 Table; after the same manner altogether as the nerves of the arme are implicated one within another.

CHAP. XXIX.

Of the nerves of the Holy-bone.

 Vt of the marrow concluded within the racks of the Holy-bone do issue fixe coniugations of Nerves. *Galen* reckoneth three of the Holy-bone, and three of the rumpe-bone. But *Vesalius* and *Columbus* doe heerein reprodue *Galen*, with what euidence of truth I cannot say, it appeareth manifestly that he was not ignorant of these bones euen in the bodies of men.

The first Coniugation [table 22, character 25] issueth betwixt the last racke-bone of the loynes

loynes and the first of the Holy-bone after the same manner as it was in the coniugations of the loynes, and is divided into an *anterior* and a *posterior* branch. The *Anterior* branch, although the greatest part thereof be mixed with the Nerves which are conveyed vnto the leg, yet notwithstanding it sendeth a propagation [ta. 23, ch. 53] vnto the inside of the haunch-bones from whence furcles are offered to the Muscles of the *Abdomen* and the seventh muscle of the thigh which is called *Iliacus internus*. The *posterior* branch runneth after the same manner as do the other Coniugations, and shooteth a propagation [ta. 24, ch. 54] into the muscles produced from the haunch-bone, especially into the first moouer of the Thigh from whence issue furcles consumed into the skin of the buttockes.

The five last.

Their anterior branches.

The five subsequent Coniugations [ta. 23, from ch. 26 to 30] are produced after one and the same manner: for before their egress they are on both sides double and on either side one Nerve falleth forward, and on either side one Nerve backward. The three vpper Anterior or forward nerves, as also that of the first coniugation, doe run vnto the leg: the two lower vnto the muscles of the fundament and the bladder, haply also to the priuy parts, in some bodies vnto the Necke of the Wombe, of the bladder, and of the yard. Finally, others are conveyed vnto the *Perinæum*, that is, the place betwixt the Cods and the Fundament, and vnto the cods themselves.

Their posterior branches.

The Posterior branches [ta. 24, ch. 54 55] are distributed into the muscles which take vp the *posterior* part of the haunch and holy bones; into the muscle of the backe called *Longissimus*; into that which is called *Sacer* or the holy Muscle; into the Membranous beginning of the broad muscle of the Arme and the fixt of the Chest called *Sacrolumbus*: finally into the fore extenders of the thigh, and into the skin of the buttockes.

But the termination or end of the spinall Marrow [ta. 23 and 24, ch. 56] issuing out of the Holy-bone both on either side part with a propagation which sometimes is distributed into many furcles on the right hand and on the left, which is disseminated through the fourth muscle of the thigh through the skin which is betwixt the buttockes even vnto the fundament; yet some say that it is distributed as other nerves are, and call it *Nervum sine coniuge* the Nerve without a companion: and thus it is in man. But in Apes and Dogs there are three Coniugations of which the two lower onely are produced forward and backward; the rest of the Coniugations issue out at the sides of the rumpe bone, as they do out of the rack-bones of the Chest and of the Loynes.

The summe of all.

How necessary the knowledge of this is for Chirurgions.

From this History of the Nerves of the spinall marrow we conclude that it hath thirty coniugations or paires of Nerves, seven of the marrow of the necke, twelve of the marrow of the backe or of the Chest, five of the marrow of the Loynes, six of the marrow of the Holy-bone. And all these with their severall originals, places of egress and distributions, not onely Physicians but Surgeons also ought necessarily to know that they may be able to apply their Vnguents and Cataplasmes vnto the right places of the spine or ridge when either the Nowle, or the face, or the necke, or the hands, or the partes of the chest, or the muscles of the *Abdomen*, or the wombe, or bladder, or the fundament, or the yard, or the legs shall bee deprived of motion or sense, or both together. Thus much concerning the nerves of the spinall marrow, and the parts thereof.

CHAP. XXX.

Of the Nerves of the Hand in the large acception,

The Hand,



H B Hand is the Instrument of Instruments, that is to say, the Instrument of the minde or Soule whereby she frameth and fashioneth all Instruments which consist of any matter whatsoever, or haue respect vnto any commodity or profit of man. And therefore that it might more freely do the service it was ordained for, it hath in allowance not only muscles the instruments of voluntary motion, and veines which convey bloud and nourishment vnto it, and arteries to give it vigour and vivacity: but also it hath nerves as well to convey the motiue vertue vnto the muscles, as also to furnish it with the most exact sense of touching. There are therefore disposed vnto the Hand sometimes five paires of sinewes, sometimes sixe, arising from the spinall Marrow contained in the rack-bones of the Necke and Chest, that is to say, out of the fift, sixt and seventh of the Necke, and the first and second rackes of the chest. These Nerves do issue out of the common perforations of the aforesaid rack-bones, and presently after their egress are united at the sides of the spondels: after-

Hath 5 paires of sinewes.

afterward they are separated, againe conioyned, and finally separated, so seeming to make the mesh of a net, [ta. 25, fi. 3.] For, saith *Columbus* and that out of *Vesalius*, it is like the strings of a Cardinals hatte. This implication was made for more security that the nerves which were to walke a longer iourney might become harder, and so stronger to propulse or endure any iniury that might be offered vnto them.

These nerves run vnder the clauike or cannel bone vnto the inner processe of the shoulder-blade, where the Basilica veine and the Axillary artery keepe their way, and hence it is that wounds in this place are so very dangerous, and luxations of the shoulder do easily bring a consumption vpon the Patient.

Why wounds about the clauike are dangerous, and the luxation of the shoulder.

From this fore-said implication or complication of the sinewes do the nerves of the hand or of the arme arise, and creepe betwixt the skin and the fleshy membrane deeply drenched in fatte in the bodies of men, and by their mediation that fleshy membrane is indissolubly fastned to the skin, but they do not alwayes retaine the same magnitude position and number; alwayes they are distributed into many backward branches, but the greater nerves Nature hath worthily distributed into the insides of the hand because by them it performeth all his actions.

The first nerve of the hand is a surcle of a branch of the fist nerve of the necke [tab. 25, fig. 1,] which runneth through the vpper and externall part of the arme, [table 25, fig. 1 and 2, f] and is diuided into two branches. The one vpper, which is sent vnto the muscle called *Deltoides*, [table 25, fig. 1, and 2, b] from which a branch [table 25, fig. 1, and 2, g] is communicated to the skin that lyeth vpon the same muscle being accompanied with the humerary vein. The other being accompanied with a vein and an artery, at the sinus or bosome of the blade passeth on vnto the second muscle of the bone *Hyois* called *Coracohyoideus* which occupieth the vpper part of the shoulder-blade, and to a part of the *Deltoides* and the skinn of the middle of the arme on the vpper side, [table 25, figure 1, and 2, i] and maketh the first nerve of the arme. [ta. 25, fig. 1, 100] It determineth a little vnder the middest of the length of the arme.

The first nerve of the hand.

The second nerve of the hand [table 25, fig. 1, e] is bigger, and taketh his beginning from the complication which the nerves that are to goe vnto the arme do make at the sides of the rackbones. Thence it falleth by the anterior and middle part of the Cubit, and first of all communicateth a small branch to the muscle called *Biceps* which is the first of the Cubit, [ta. 25, figure 1, 100] afterward it ioyneth with the third nerve, [Table 25, figure 1, and 2, r] and after the coniunction it creepeth downward, [table 25, figure 1, o] and from the outside sendeth a small branch [table 25, figure 1, r] to the muscle of the Wand called *Supinator longior*. But when it hath attained vnto the bent of the cubit it is diuided into three branches, (sometimes into two, but then the lower is againe subdivided) one vpper and smaller, [table 25, figure 1, creeping from the vpper E vnto the lower E] which passing a good way by the outside of the arme with a branch of the humerall veine runneth vnto the outside sometime of the first, sometime of the second ioynt of the thumb, and intertexeth that part with small surcles. The second [table 25, figure 1, o] is the middle-most and something larger then the former. It lyeth vnder the foresaide humerall veine where the Median or Common veine ariseth thereout (and descendeth with an oblique passage along the cubit, but aboue the fleshy pannicle) euen vnto the wrest. [table 25, fig. 1, 100 above 44.] The third is the lowest. [table 25, fig. 1, 100] His progresse is somewhat oblique and is fastened to the interior branch of the Basilica veine, and in the cubit is diuided into two branches, [tab. 25, fig. 1, 100] at length ouercomming the wrest it distributeth surcles to the skin on the inside of the hand, from which sometimes small shootes do attaine vnto the outside of the thumbe, which are commixed with the surcles of the posterior branch.

The second.

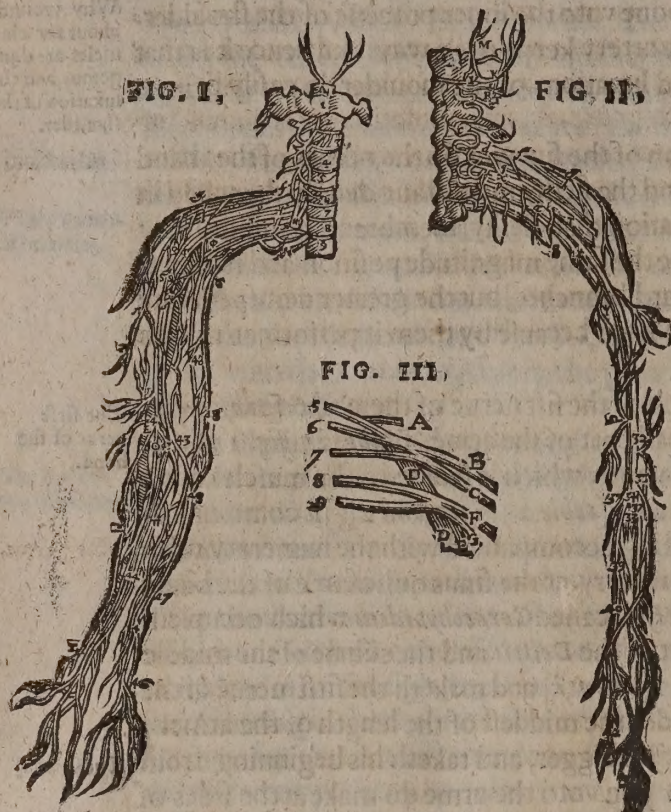
His diuision into three branches.

The third nerve of the hand [table 25, fig. 2, r] runneth through the fore and lower side of the cubit and vnder the double-headed muscle in the arme is increased with a branch of the second nerve. [tab. 25, fig. 1, 100] Presently after it is diuided and affoordeth two branches to the skin on the forepart of the arme [tab. 25, fig. 1 v betwixt 1 and 2.] When it hath attained vnto the bent of the cubit, it is mingled with the fist paire, [table 25, fig. 1 ch. 43] and sendeth small branches vnto the muscles which grow out of the inner protubetation of the arme: from hence it reacheth a notable branch obliquely to the *Radius* or wand, [ta. 25, fi. 1 ch. 44] which being accompanied with a veine and an artery is parted into 3, and runneth into the inside of the hand, communicating 2 surcles to the thumbe, two to the fore finger, and one to the vpper side of the middle finger. And when this middle finger doth not receiue a surcle from the fist nerve, then it alloweth two to the middle & sometimes one to the Ring-finger.

The third.

Table 25. Fig. 1. and 2. sheweth the Nerves of the whole hand, the first figure sheweth their fore-side, the second their back-side.

TABVLA XXV.



7 1, a branch of the eight paire going to the top of the breast. 2 2, Surcles from the eight paire going vnto the muscles of this place. charact. 9. in the first figure, the ninth paire of nerves. 8 1, the hinder branch of the ninth paire. 9 2, the fore branch of this coniugation. 10 1, the first nerve of the arme going vnto the skinn. 1 1, the second nerve of the arme. 11 1, From this doe proceed nerves going vnto the first muscle of the Cubit called *Biceps*. 12 1, the third nerve of the arme. 13 1, a branch thereof to the skinn of the arme. 14 1, A small branch going vnto second muscle of the cubit, called *Brachialis*. 15 1, to the skinn of the fore-side of the arme. 16 1, the meeting of the third nerve with the second. 17 1, the second nerve, together with the third, creeping downward. 18 1, a nerve to the second muscle of the *Radius*, called *Supinator longior*. 19 1, the diuision of the second nerve into three branches. 20 1, the vpper or first branch of the second nerve, running vnto the wrist, and so vnto the first ioynt of the thumbe. 21 1, the middle branch of the second nerve. 22 1, his progresse euen vnto the hand. 23 1, the lower and third branch of the second nerve. 24 1, two branches of this nerve going vnto the inside of the hand. 25 1, 2, the fourth nerve of the arme. 26 2, nerves from this vnto the extending muscles of the Cubit. 27 1, a branch vnto the skinn on the back-side of the arme. 28 2, to the skinn on the outside of the arme. 29 2, A branch creeping along the outside of the Cubit vnto the wrist. 30 2, the bypartition of the fourth nerve at the Cubit. 31 2, the vpper branch of the said diuision. 32 2, the surcles which belong to the thumbe, the forefinger and the middle finger on their out-side. 33 2, the lower branch of the afore-said diuision. 34 2, surcles therefrom vnto the muscles arising from the externall prouuberation of the arme. 35 2, 36, 37, 38, 39, 40, 41, 2, three branches going to the muscles that arise from the *Vlna* or *El.* 42 2, the end of the branch 37, neare the ioynt of the wrist. 43 1, 2, the fifth nerve of the arme. 44 1, Propagations of the third and fifth nerves, vnto the inside of the Cubit. 45 1, a branch of the third nerve, going vnto the palme of the hand and the fingers. 46 1, a branch of the fifth nerve vnto the inside of the hand. 47 1, a propagation of the branch 45, vnto the outside of the hand. 48 1, 2, the sixth nerve of the arme. 49 1, his end neare vnto the ioynt of the hand. 50 1, 2, surcles from the sixth nerve vnto the skinn.

Figure 3. Sheweth the complication of the Nerves which come vnto the arme out of Vesalius.

Char. 5, 6, 7, 8, 9. The rootes of those coniugations from which nerves are produced vnto the arme. A A, portion out of the fifth paire of the first nerve. B, the second nerve. C, the third nerve. D D, the fourth nerve which issueth out of the back-side of the congreffe or coniunction of the fifth paire and the sixth, it assumeth a portion out of the back-side of the coniunction of the seventh paire, and after creeping vnder the coniunction of the eighth and ninth paires, it also assumeth a portion therefrom. E, Which is the branch marked with E. F, the fifth nerve that runneth into the arme. G, the sixth nerve deriued into the arme.

A, the spinall marrow getting into the Racke-bones.

charact. 1, 2, 3, 4, 5, 6, 7, 8, 9. Seauen rackbones of the necke, and two of the Chest;

c 2, the forward branch of the fift paire.

f 1, 2, a branch of the nerve d, creeping to the top of the shoulder, vnder which are surcles going to the shoulder-blade.

g 1, 2, Propagations of the nerve f, going to the skin of the top of the shoulder.

h 1, 2, a branch of the nerve f, going vnto the second muscle of the arme.

i 1, 2, another branch inserted into the same and to the skin.

charact. 6, in 1, the sixt coniugation of sinewes.

k 2, the hinder branch of the sixth paire.

l 1, the fore branch of the sixth paire.

m 1, 2, a surcle thereof that maketh the nerve of the midriffe.

p 2, a branch of the sixth paire, reaching vnto the cavity of the shoulder-blade.

q 1, 2, the complication of the branch l, with the neighbour branches.

charact. 7, in the first fig. The seuenth paire of nerves.

r 2, the hinder branch of the seuenth paire.

s 1, the congreffe or meeting of the seuenth paire, with his neighbour branches.

t 1, 2, some surcles hereof going vnto the muscles of the shoulder-blade and the arme.

u 2, the hinder branch of the eighth paire.

v 1, 2, the congreffe or meeting of the eighth paire with the seuenth.

The fourth into the Arme, along the back-side, and passing along the back-side of the cubit [Tab. 29, fig. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 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601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

The secon the wand vnto two furcles finger.

The third muscles that of the wrist with the

The fifth complication bend the cub lower side of the arme [Tab. 25, fig. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955,

The fourth Nerve [*tab. 25, fig. 1, and 2, **] which is the largest of all the Nerves that runne into the Arme, taketh his beginning from the complication we spake of before. It runneth along the backward and vpper part of the cubit ouer the external protuberation of the arme, and passing along with the *Deepe-veine* and the Axillary artery, it inflecteth it selfe at the vter and back-part of the arme, and distributeth two branches to the extending muscles of the cubit [*tab. 29, fig. 2, **] and to the skin which is at the ioynt, and vnto the backpage, and another vnto the vter part. [*tab. 25, fig. 2, and char. 32, **] Afterward neare the ioynt of the cubit at the externall protuberation of the arme [*tab. 25, fig. 2, char. 34, **] it is sometimes deuided into two trunks which lye deepe as doth their roote; [*char. 35, 37, **] sometimes it is diuided into three branches, [*char. 33, 35, 37, **] whereof the exterior [*tab. 25, fig. 2, char. 33, **] runneth along the outside of the cubit wherevpon it bestoweth branches and descendeth obliquely to the wrest.

The fourth.

His diuision.

The second which is the higher [*tab. 25, fig. 2, char. 35, **] runneth throughout the length of the wand vnto the outside of the Hand [*tab. 25, fig. 2, char. 36, **] and is consumed or spent into two surcles which passe vnto the thumbe, two into the fore-finger and one into the middle finger.

The third [*char. 37, **] descending by the length of the *vlna* or Ell, affordeth surcles to the muscles that extend the fingers [*char. 38, 39, 40, 41, **] and is consumed or spent into the outside of the wrest intrangling with some surcles at the roote thereof [*char. 42, **] the ioynt of the wrest with the cubit.

The fift nerve of the Hand [*tab. 25, fig. 1, and 2, **] taketh his beginning from the foresaid complication, and being fastned to the fourth runneth betweene the muscles that extend and bend the cubite, (yet distributeth no branches to the *Radius* or wand) on the backward and lower side thereof, and when it attaineth to the inner cauity of the proceffe or protuberation of the arme, at the fore side of the cubit it is a little reflected, and affordeth propagations [*tab. 25, fig. 2, char. 43, **] to the muscles which arise from the inner protuberation of the Arme, as also from the Ell and the wand, which muscles doe not receiue any surcles from the third nerve.

The 5 nerve.

From thence passing with a notable branch and being accompanied with a veine and an artery it is fastned to the Ell, and in the middle of the cubit is deuided into two branches [*tab. 25, fig. 1, char. 45, and 46, **] one internall [*char. 45, **] which is conuayed by the inside of the Ell, amongst the muscles that bend the Fingers, and accompanied with a veine and an artery is conducted vnto the wrest, and vnder the transuerse Ligament thereof vnto the palme of the Hand, where it sendeth two surcles to the little finger, two to the middle finger, and one to the ring finger on their insides.

His proceffe.

The other external branch [*char. 46, **] at the middle of the Ell shooteth out a propagation from his outside, betweene the muscle that bends or extends the wrest, which propagation runneth along the Ell, and is lengthned to the outside of the cubit, and at the outside of the wrest bestoweth two surcles on the little finger, two on the ring finger and one on the middle finger. But we must remember that the inner branches are larger then the vter, because the vter may more easily be offended. Sometimes from this fift Nerve there are no surcles distributed to the inside of the hand: sometimes also the outside of the inner part of the middle finger and the inside of the ring finger do obtaine surcles from the third nerve, and then the fift doth onely exhibit two propagations to the inner part of the little finger, and one to the inner part of the ring finger.

The sixt Nerve, [*tab. 25, fig. 1, and 2, **] which in bignesse is answereable; to the second where it attaineth to the cubit, creepeth through the inner and lower side of the Arme and of the cubit as farre as to the hand, [*tab. 25, fig. 1, char. 47, **] and neare the inner protuberation of the arme distributeth many surcles on each side into the skin of the cubit; [*Tab. 25, fig. 1, char. 48, **] which surcles do sometimes lye vnder the branches of the veine, sometimes aboue them, and it determineth not farre from the connexion of the wrest with the cubit [*Tab. 25, fig. 1, char. 47, **]

The sixt.

Here we must note that which we touched before in the 24, Chap. that with the fourth, fift and sixt Nerves of the Hand oftentimes there are mingled certaine small Branches yssuing from the fift Coniugation of the Brayne. And thus much of the Nerves of the Hand.

CHAP. XXXI.

Of the Nerves of the foot in the large acception.

The nerves of
the legge.Their origi-
nally.

He nerves which at the beginning of the legge (by legge we vnderstand here the whole member) doe runne into the thigh and the foot, arise out of the spinnall marrow, out of that part I meane, which consisteth of the spondels or racks of the Loynes and of the Holy-bone; for they are propagated out of the three lower paires of the loynes, and the foure vpper of the Holy-bone; and in their very originall, are mixed like as we said, they were before they entred into the arme, for their coniunction is like the Meishing of a net, or Plashing of a hedge, and so proceed on either side in foure nerves [ca. 26. ch. 57, 60, 66, 71.] they are not all of a like thickeffe, neither is their passage the same, although their common originall be within the cavity of the *Peritoneum* or rimme of the belly. The first and the third are the shortest, and therefore they passe onely vnto the thigh. The second is longer and thicker then they, and reacheth through the thigh into the legge. The fourth is thicker then all the rest, put together and longer also, for it descendeth through the thigh and the leg vnto the ends of the Toes.

The 1 Nerve.

The first [table 26. charact. 57.] ariseth of a commixtion of a branch of the third paire of the Loynes with the fourth paire [about the 22 and 23 racke-bones] and is terminated aboue the ioynt of the knee. This nerve lying vpon the muscles of the Loynes, attaineth to the little *Rotator*, and is consumed into the two extending muscules of the Thigh, and a branch of it into the fore-side and out-side of the skin of the Thigh that lyeth ouer them, but the greater part [char. 59.] affordeth surcles to the first, seuenth, and ninth muscules of the Legge.

The second.

The second Nerve of the leg [char. 60.] issueth ouer against the Coniunction of the third spondell of the Loynes with the fourth, [betwixt 23 and 24.] and being accompanied with the crurall Veine and Artery, passeth through the groines into the Thigh, and descendeth in a notable branch (which on the inside [char. 61.] is fastned to the veine *Saphena*) as farre as to the great Toe passing by the inward ankle. [char. 62.] And this must especially be noted, because of the Section of the ham and inner Ankle-veines, lest if the lancet or Flegme be bent forward, you cut the nerve in sunder: and as the *Saphena* in his descent communicateth diuers surcles, so also is this Nerve diuided into many branches: the chiefe of which is that [char. 63.] which we meet withall about the fore and inside of the knee. The greater portion of this second Nerve [char. 64.] being accompanied with the deepe veine and artery is distributed into the forward muscules of the thigh, especially into the fift of the thigh and the eighth of the leg; yet so, as it disperfeth certaine small shoots into the membranes that there tyethe vessels together.

The third.

The third Nerve [charact. 66.] ariseth especially where the fourth spondell of the loynes is articulated with the fift, and passing ouer the seuenth muscle of the Thigh, it breaketh through the perforation of the share-bone [char. 67.] and reacheth surcles to the ninth and tenth muscules of the Thigh, as also to the muscles of the yard, which arise from the share-bone. It produceth also two Nerves that descend vnto the middle of the Thigh; one of which is sprinkled into the skinne of the Thigh neere the Groyne, [char. 68.] the other is consumed into the second Muscle of the Legge, and into a part of the fift Muscle of the Thigh.

The fourth.

The fourth Nerve [charact. 71, 72.] is sixe times as bigge as the third, yea to say true, of all the Nerves of the whole body it is the thickest, hardest, strongest, and dryest. This is compounded of the foure vpper paires of the Holy-bone, or of the 25, 26, 27, and 28 coniugations. It goeth on the backside of the Thigh, betwixt the *Holy* and the haunch-bones; for where they depart either from other, it runneth into a peculiar cavity or *sinus* of his owne, and first shooteth out surcles from a branch lurking on the backside [char. 72.] vnder the first muscle to the skin, which couereth the buttocks and the backside of the thigh euen vnto the middest thereof. Afterwards, it distributeth other branches on either side, [char. 73.] which for the most part are three, vnto the heads of the third, fourth, and fift muscules of the legge, and the fift of the thigh. Thence forward it is hidden amongst the Muscles, and below the middle of the thigh, sendeth a branch [char. 74.] vnto the fourth muscle of the legge, and sprinkleth propagations into the skin neere the knee. Next in the lower

His diuision,

part

TABVLA XXVI. Sheweth the Nerves of the foot in the large
reception.

From 20 to 24 E. Five paires issuing out of the
Spondels or rackebones of the loynes.

50, 50. Nerves going vnto the muscles of the
Abdomen.

5. Branches from these Nerves vnto the broad
muscle of the arme.

From 25 to 30. fixe paire of Nerves of the Holy
bone.

53 a branch of the paire 25 to the inside of the
haunch bone, and the muscles of the haunch-
bone issuing therefrom.

56 The termination or end of the spinall mar-
row vndiuided.

57 The first Nerue running vnder the Leg or the
Thigh.

58 Branches going from this Nerue vnto the
skinne.

59 Hence also branches going to the muscles
that occupy the outside of the Thigh.

60, The second Nerue of the leg.

61, 62, From this nerue goe branches through
the inner side of the Thigh and the Leg, vnto
the lowest part of the Leg at 62.

63, Surcles from the branch 61 disperfed into
the knee.

64 A branch of the second Nerue running vnto
the depth of the thigh.

65 Hence also a branch vnto the muscle of the
thigh called *Triceps*.

66 The third nerue of the leg.

67 Propagations from this third nerue, vnto the
muscles occupying the hole of the share-
bone.

68 Another branch vnto the skinnie on the inside
of the thigh.

69 A portion of the third Nerue, lying deepe
which goeth vnto the muscles.

70, A portion to the second bending muscle of
the leg.

71, The fourth nerue of the leg which is the thic-
kest of the whole body.

72 A propagation hereof vnto the skinnie on the
backside of the thigh.

73, Another propagation to the heads of the muscles arising from the appendix of the *Cera*. 74, another vnto the
fourth muscle of the leg, and vnto the skinnie that is at the ioynt of the knee. 75, Surcles from the fourth nerue vnto the
heads of the muscles of the foote. 76, the diuision of the fourth nerue of the Hamme into two trunks. 77 The lesser and
vnter trunk of this diuision. 78, 78, A branch of the same trunk stretched vnder the skinnie, and carryed to the outside of
the leg and the foote. 79, the greatest part hereof betwixt the Leg and the Brace. 80, A branch distributed vnto the fore-
of the leg vnder the skinnie from the branch 79, 81, the greatest part of the branch 79, going vnto the muscles of the
foote. 82, The inner and thicker trunk of the fourth nerue of the leg in the arme. 83, A branch creeping along the
inside of the leg and of the foote. 84, a branch of the trunk 82, disperfed into the skin of the Calf. 85, 85, a branch of
the trunk 82 creeping through the forefide of the leg vnto the top of the foote. 86, another branch creeping behind
amongst the muscles of the foote. 87, The remainder of the trunk 82 conuayed downe by the inner ankle, and in his
lower part affording to euery toe two small surcles.

part it disseminateth on either side one surcle, [char. 75.] at the head of the thigh into the
heads of three muscles of the foote. But the trunk it selfe in the backward cavity of the
knee, or in the hamme [char. 76.] is diuided into two branches of vnequall thicknesse, [char.
77, 82.] which are distributed into the whole legge and the foote: for the leg hath no branch
from any nerue, sauing this alone, vnlesse it be a branch of the second paire [char. 61.] which
runneth through the inside of the thigh, the leg and the foote; and yet sometimes a branch
of this fourth nerue is faine to supply the place of that also.

The vnter of these two vnequall branches and lesser [char. 77.] is presently byfurcated;
[char. 78, 79.] and the greater and vnter part of that byfurcation [char. 78.] which is produ-
ced presently about the hamme, descendeth along the Brace and the outward ankle, to the
out-

The vnter
branch.

outside of the foot and the little toe, in his way offering furcles to the skinn: The other and interior part of the byfarcation which sometime also is the greater, [char. 79.] when it hath conuayed a branch [char. 80.] vnto the forepart of the leg, it is hid neere the Brace among the muscles that are called *Peronei*, and affordeth branches vnto them. [char. 81.] From thence it stealeth along, and is returned toward the vtter ankle.

The inner
branch.

The *interior* and greater of the vnequall branches [char. 82.] runneth secretly vnder the muscles along the backside of the Leg, together with the fift muscle of the Foot, and the benders of the Toes seated in the Leg, and being reflected at the backside of the inner ankle, attaineth vnto the soale of the foot, and communicateth most what to each Toe two furcles. This branch is subdivided, and from the greater trunk [betwixt 82 and 85.] a little vnder the diuision, and in the inside thereof issueth a branch at [ch. 84] which is distributed into the skin of the Calse. Afterward the trunk falling into the leg, and stealing vnder the muscles thereof, propagateth yet two branches, one carryed forward, which is greater then the other [char. 85] and passeth through the Membranous Ligament which fastneth the Leg and the Brace together; neare which Ligament it creepeth downeward, affording furcles to the muscles of the Toes to which it is fastned, and passing vnder the transuerse or annular Ligament, together with the tendons of the foresaid muscles, it attaineth vnto the vpper part of the foot, and is distributed into the muscles of the great Toe and those that leade the Toes backward. The other branch which is the lesse, runneth backward, [char. 86] and passeth through the hinde side of the leg, and is consumed into the muscles of the foot amongst which it walketh.

His distribu-
tion.

The lesser trunk [char. 83.] creepeth along the inside of the legge vnto the inner ankle, thence to the inside of the foot, euen vnto the great Toe, and in his progresse sprinkleth diuers furcles into the skin.

Columbus, after he hath made mention of this great and notable nerue, and the distribution thereof, addeth; After the three perforations of the Holy-bone, follow in some bodies the fourth and the fift, out of which doe issue two other coniugations of nerves which after their egress are likewise vnited and beget a nerue, which is reflected and distributed into the muscles of the buttocks and the skin of the same. It sendeth also small nerves into the inside of the *Abdomen*, vnto the muscles of the right Gut; in some men also vnto the muscles of the bladder; in women into the wombe, the necke thereof, and to the muscles of the bladder: others also passe into the *Peroneum* and *Scrotum*, or the Cod. Out of the backpart of the Holy-bone, through his perforations do issue small nerves little and short, which are dispersed into the muscles of the backe, to the buttockes and the skinn of the backside.

The conclu-
sion.

And so haue we brought to an end our History of the Vessels, whose curled streames and wandring passages, if I haue not euery where so exactly troden out, as to giue my selfe contentment: yet I presume that few will be able (if there be any) to find my error. Notwithstanding, I confesse that in two or three places, I haue not been able to comprehend the meaning of my Authours, if at least, they comprehended their owne. Yet I did compare them diligently together; but it is no wonder that in such intricate labyrinths and inextricable Meanders, he that is best acquainted with them, should some time be at losse, in which respect, he that is best able to finde the fault, I hope will soonest pardon the offence.

I proceed in my taske.

The end of the eleuenth Booke.

THE TWELFTH BOOK,

which hath $\left\{ \begin{array}{l} \text{Of Gristles.} \\ \text{Of Membranes.} \end{array} \right.$
 foure parts, $\left\{ \begin{array}{l} \text{Of Ligaments.} \\ \text{Of Fibres.} \end{array} \right.$

The Præface.



VR Webbe now weares neare the Threds. The glory and beauty of this stately Mansion of the *Soule* we declared in the first booke. The outward walles we dismantled in the second. The Cooke-rooms and sculleries with all the houses of Office and rooms of repast we suruayed in the third. The Geniall bed and the Nursery we viewed in the fourth and fift. In the sixt we were ledde into the rich Parlor of pleasure, wherein we were entertained by a leuy of Damozels; one *Modest* as *Modesty* it selfe: another *Shamefast*, another *Coy*, another *Jocond* and merry, another *Sad* and lumpish, and a world of such *Pastions* we found inhabiting in the *Little world*, there also we saw the curious clocke of the heart mooued by a perpetuall motion; the Heralds of honor, those nimble and quicke Pursuants, those agile spirits whose presence giues life, whose pleasance giues cheere and refreshment whither soeuer they are sent. From thence we ascended in the seuenth Booke by staires of Iuory into the presence Chamber, where the *Soule* maketh her chiefe abode; there we saw the Councell gathered, the Records opened, and Dispatches made and signed for the good gouernment of the whole family. From thence in the eight Booke we clombe vnto the battlements, and saw the watch of the Senses set to discouer and giue warning of the approaches of enemies. In the ninth we obserued the guard appointed to fetch in the prouision from without, to entertain or giue the repulse, to defend or offend as cause required. In the tenth wee discouered the Materials which filled vp the empty distances in the walles, and parted the rooms asunder. In the eleuenth we followed the courses and conuayances, the entries and Lobies which leade throughout the whole edifice from chamber to chamber, out of one office into another. Now we are arriued neare the principals of the building, where we may see how they are ioyned, how they are fastened and bound together, how they are couered and defended, how they are interlaced and intertexed. And finally, in the next and last booke we shall (with God to friend) come vnto the Principals themselves and to the very foundation and ground-worke whereon the whole Frame is raised.

The first part, of Gristles.

CHAP. I.

Of the definition, use, and differences of Gristles.

BEfore we come vnto the particular Histories of the Gristles, it will be requisite to speake something in generall which may open their nature, vses, and differences. A Gristle therefore is a similar part, cold and dry, made out of the thickest part of the seed gathered together by the power of heat, and ordained to secure the variety of motions, and to put by outward violence. That it is similar is very manifest, because it is altogether of the like it selfe, the least fragment or particle thereof retaining the nature, temper, and name whole.

This Gristle, if we will beleue *Galen*, is to be numbred in the list of those parts which are gouerned by themselves and do not gouerne others. It is cold because the heat soone vani-

The definition
of a Carti-
lage.

The explicati-
on of the de-
finition.

sheth

sheth away, and dry for that the moysture is vapoured from it, whence also it becommeth hard but not so hard as a bone.

The matter of it is the crassament or thickest part of the seede. The efficient is heate, which is the immediate organ of the procreating Faculty, to which the *Altering* and the *Forming* vertues are assistant: yet is not this an extending heate, such as whereby the Membranes are dilated; nor perforating, such as boreth the Veines and Arteries, but a more remisse degree with gathereth or curdleth the parts together, and is indeed proportionable to cold in outward things, there being nothing actually cold in a liuing body. But as a high degree of heate doth melt the Lead which caketh when it is lesse hotte though a great heat do remaine yet in it; so it is in the body, the greater heate diuiderth the parts and the lesser gathereth, or if wee may so say, congealeth them.

The finall cause is expressed in the last particle of the definition, for although there be diuers uses of Gristles as we shall shew by and by, yet these two are principall. First, to make the ioynts of the bones which are coupled by *Diarthrosis* more gladde or easie to moue, and more secure and permanent. Secondly, to defend the parts vnder them from outward impressions or iniuries.

The Nature of a Gristle is not much vnlike that of a bone; for saith *Aristotle*, when the bones are in any creatures wanting, the supply is made by Gristles. Their Tempers also are not farre asunder. Sense they haue none, because the creature should not be in perpetuall paine, neither indeed haue they any Nerues dispersed through them. Notwithstanding as we shall say in the next Booke there are some kinde of bones which haue Sense, the teeth for instance; So some Gristles seeme to haue Sense, as those of the Eye-lids, because certaine small Tendrils of Nerues do touch them.

Finally, saith *Laurentius*, a bone and a gristle do differ but *secundum magis & minus*. For bones are harder, drier and colder: yet we may say further, that all Gristles are transparant, smooth and polished, many bones vnequall and sharpe. Moreover, a Cartilage or gristle hath no marrow, nor cavity, nor corners, or celles in it as bones haue, because there was no need of them, for being not so thick or solid as a bone their aliment doth easily passe through their substance. We conclude therefore, that a gristle is of a middle nature betwixt a Bone and a Ligament, faster or thighter then a Bone and harder then a Ligament.

How Gristles
and Bones doe
differ.

The uses of
the Gristles.

The first,

The uses of the Gristles are diuers and those very admirable and wonderfull. The first and most common vse is to helpe the motion of the bones which are ioyned with a laxer or loose articulation, for by the helpe of the Gristle the motion becommeth more easie, more secure and more permanent. More easie, for being smooth and polished, it leuigateth and maketh slipper the asperities or roughnesse of the bones, and so their heads become more glib or prompt in their motion. Whence it is that all moueable ioynts are crusted ouer with a Gristle: So also are the heads, and the *sinus* or cups or cavities of bones where they touch one another lined with a smooth gristle. They make the motion more secure, because the gristle encreaseth the hollownesse of the bone that so the articulation is not so easily luxed or put out of ioynt, as we may see in the articulation of the arme with the shoulder-blade, and in many others. Finally, by the inter-vening of the gristle the motion is preserued and made more lasting and dureable, for the extremities or ends of bones being very hard by their mutual contraction and perpetual attrition would haue been worne and fretted, and so in time the motion would haue decayed, which inconuenience is auoided because they are compassed or lined ouer with a soft gristle.

The second.

The second vse of Gristles is by yeelding to illude or breake the occurrance of outward iniuries, as when the bones are beaten or ratled together, or some other violence offered, which haply might breake a bone: for being of a middle nature betweene very hard and very soft, it cannot be easily broken, as that which is hard and friable or brittle, nor easily wounded or bruised, as that which is soft and fleshy.

By-vses of
the Gristles.

Hence it is that the Extremities of many bones which are exposed to external offence haue gristles allowed them, as the Nose and the Eares. And these are the chiefe and primary uses of gristles: there are also many other by-vses, as some gristles like bones do sustaine some parts, some haue muscles affixed vnto them, and some do sustaine or establish the vessels. Such are the gristles of the *Larynx* or throtle and the rough artery, as also those of the eye-browes, into which as into a pale the beard of haire whereby the eyes are defended, are infixed.

The fourth.

There is also a fourth added, as if they should be defences or muniments to safeguard the parts subiected vnder them. So the gristles of the brest-bone and the ribs were made for the

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the defence of the heart and of the lungs, although they make indeed the motion of the chest more easie, because they follow with more readinesse then bones would, his distention and contraction. In like manner the sword-like cartilage which we call the brest blade is thought to haue bin ordained to defend the midriffe & the mouth of the stomach when it is distended.

A fift vse of the Gristles you may gather out of *Galen* his booke *de ossibus*, that by their mediation as it were by a glew some bones might be conioyned. So the share-bones are vnited by a Gristle, and that kind of coniunction is called *Synchondrosis*. The fift.

I will adde also a sixt out of *Galen*s eleuenth booke *de vsu partium*, to ioyn hard and dense bones with lax and rare, for it filleth or maketh vp the hollow holes of a rare or lax bone, and leuigateth or maketh smooth his rough sharpenes. The sixt.

Finally, there are other and those very many peculiar vses of particular Gristles. Some belonging to the sight, some to hearing, some to smelling, some to digestion or swallowing, some to respiration or breathing; some to apprehension and some to progression, as partly hath bene and shall further be declared in the History. Many peculiar vses.

For the differences of gristles they are to be taken from their substance, magnitude, figure, site, vse, and connexion. From the substance or rather from those things which follow the substance, that is, hardnesse and softnesse; some gristles are hard which at length become bony as those that forme the *Larinx*; others are in a meane which doe neuer degenerate into the nature of a bone, as that which we call the *Epiglottis* or *Ouer tongue*; others are soft which tye the ioyns together & carry in them the nature of a ligament, & such are called *Χονδροσύνδεσμις*. From the magnitude; some are great and others are small. From the figure, which is very diuers, Gristles haue diuers names, as *Ensiculata*, *Annularis*, *Scutiformis*, *Aritenoides*. The blade Gristle, the ring Gristle, the shield Gristle, the ewre Gristle. From the site, some are called vpper, some lower, some fore, some after, some internall, some externall Gristles. From the vse we may also gather differences and varieties of Gristles. Some are made for motion, some to auoyd outward iniury, some for defence and some onely for supportation. The differences which are taken from Connexion are more necessary and therefore a little the more to be stood vpon. A gristle therefore either groweth to a bone or maketh a part by it selfe. That which tyeth two bones together, either doth it by the interposition of common ligaments, as it is in the end of bones that are connected by *Diarthrosis*, or immediately as in the share-bones and the brest-bone. That which is fastened to a bone appeareth in the gristle of the Nose, in the brest-blade and that which groweth to the *Coccyx* or the Rump. The gristle which maketh a part by it selfe is by some called *Solitaria*, such is the gristle in the extremity of the Eye-liddes, such are the gristles of the *Larinx* or Throttle; of the rough artery, of the outward eares and of the *Epiglottis* or Ouer-tongue. The differences of Gristles.

But for more perspicuity we wil referre the whole history of the gristles vnto three heads. Those of the head, those of the trunk, and the gristles of the ioyns: the gristles of the head are, of the Nose, of the Eares, of the Eye-lids and of the lower Jaw. The trunk is diuided into the Spine and the Chest. The parts of the spine are the necke, the backe, the loynes, and the holy-bone. The gristles of the necke are either behind or before. Behind, those that tye the spondels together; before, the Throttle, the Rough artery, and the Ouer-tongue. The gristles of the chest are those in the extremities of the ribs, and those of the brest-bone. The gristles of the ioyns are some of bones receiuing, some of bones receiued, and of each of these some belong to the Hand and others to the Foote. Now we descend to the particulars. A diuision of Gristles.

CHAP. II.

Of the Gristles of the Face.



F the Eye-lids we haue spoken before in the third chapter of the eight booke which we will not now repeate, onely heere remember that a great part of them are cartilaginous or gristly, by which the opening and shutting of the eye is made equall, by which the violence of outward iniuries is better resisted, and in which the small haire that keepe dust and flies from the eyes are infixed and sustained, which otherwise would haue fallen if the lid had bene onely made of flesh and membranes. The Gristles of the eye-lids.

Againe, if they had bene bony, they would not haue bene so easily moued, and beside, their hardnesse would haue offended the coates within the eyes which are of exquisite sense. But this gristle is very thinne that it might be a little transparant to cast a little shadow

dow of the externall light vpon the eye. There are two of them, one vpper, and another lower; the vpper is greater in a man, and in those creatures whose lower eye-lids are im-moueable, or their motion (if it be any) very little and obscure, whereas in Birds the gristle of the lower lid is the greater. They are called *ragodi*, because the row or beard of haire, which is set in so many perforations made in the gristle, are not vnlike a ranke of rowers in a Gally. There is also another gristle in the greater angle of the eye, which hath the figure and vse of a Pulley, described elegantly at the first by *Falopius*. This Pulley hath a Canale or open perforation through which the tendon of the muscle that moueth the eye round is conueyed, but of it we haue spoken before. In the ioynt of the lower iaw there is a slippery and moueable gristle which interposeth, lest the bones of the temples, and the iaw should by their mutuall attrition be worne, or when they are wearied with too much labour giue ouer their motion.

Of the out-
ward eares.

The outward eares called in Latin *Auriculae*, are also gristly, for if they had bin bony they might easily haue bin broken, and beside would haue bin an impediment in our sleepe.

Againe, if they had been soft and fleshy, they would not haue retained their arched figure, and so the ayre should haue bin shut out, or if it had bin admitted, a fleshy substance could not haue repelled the sound. These gristles are aboue, thicker & harder; below, thinner and softer till you come to the lap which is of mixed nature betweene flesh and gristle.

Of the nose
are five.

The gristles of the Nose are five, the three anterior are fastned to the circumferences of the bones, and two make the wings.

Of these the two vpper are the broadest and adhere to the bones of the Nose [*tab. 12. lib. 8. fig. 8. from f to e*] where they are broad and rough. From them they hang, and together with them doe forme the anterior cauity of the nostrils and their lower part. Descending downward they run out being fastned together vnto the tip or top of the Nose, and the lower they goe, the softer they are, in the very extremity degenerating, as it were into a gristly ligament. The third gristle, which is in the middest betwixt these two is called *Septum cartilaginofum*, the gristly partition, which groweth to the bony partition, for it depending forward groweth to the foresaid gristles throughout their length on the inside. This is the gristle which maketh the Nose to rise in the face, and distinguisheth the two nostrils, where also the bony partition aboue the region of the Pallate, separateth the perforation of the nostrils from the Nose vnto the Chops. To these three gristles, other two are annexed which make the wings of the Nose called *ala* or *pinna*, because like wings they shut and open the nostrils, and they are tyed with membranous ligaments to the former gristles on their inside. Each of these gristles is orbicular, and so make the holes of the nostrils round, and indeed they approach neare vnto the nature of a ligament.

Their vse.

Moreouer, they haue voluntary motion, being drawn vpperward and downward, inward and outward by proper and peculiar muscles, and in great inspirations they are a little eleuated, but in expirations doe settle againe. They are seated in the lower part of the Nose, for the vpper is bony to be a foundation vnto the rest: but it behooued that the lower part of the Nose should be gristly, partly that the cauities might remaine alwayes open for the better attraction of the ayer into the Lungs, and into the braine; partly that being soft, wee might close our noses against any euill fauours, partly also the better to euacuate the excrements of the braine through the nostrils; and finally that they might yeeld to outward violence, to which they are most of all exposed. This part of the Nose if by any casualty it shall happen to be cut off, may be elegantly restored by a *Traduction of skin out of the arme* as we shall (God willing) at large discourse and exhibite the figures of that kinde of deligation in our worke of Surgery. And so much concerning the gristles of the Face.

CHAP. III.

Of the Epiglottis, the Gristles of the Larinx and of the Weazon.

Epiglottis.



F the *Epiglottis*, the gristles of the Throttle, and the Weazon wee haue spoken before in the eighteenth chapter of the sixt booke, and in the 34 and 36 chapters of the eight booke; wherefore here it shall be sufficient to touch vpon them and so to passe vnto the rest that follow. You must therefore remember that the *Epiglottis* is nothing else but a gristle that lyeth vpon the cleft or slit of the *Larinx* made

of

of the two processes of the Ewre gristle. The forme of it is compared to an luy leafe, whose basis is broad but the cone not very sharpe. The basis is in the vpper and inner side of the shield gristle, the cone vergeth toward the Pallate. If this gristle had been bony, it would not so easily haue been depressed in deglutition, nor readily againe lifted it selfe vp for the inspiration of ayer. If it had been fleshy or membranous, it would indeed haue easily fallen but not so readily risen againe. The vse of it is double. The first to couer the Larinx, that in swallowing the meate and the drinke might not passe into the Lungs, for the gullet lies behind the wind-pipe. The second vse is to breake the ayer that is driuen out of the Lungs and to Modulate the voyce.

This gristle saith *Laurentius* standeth alwaies yawning open, as well when we draw in our breath as when we breathe it forth. Neither is it at any time depressed of it owne accord but onely by the weight of the meate and drinke which wee swallow, neither at that time is it so exquisitely closed vp but that a portion of the drinke sipeth by into the rough Artery.

As the *Epiglottis* is the couer of the *Larinx*, so is the *Larinx* the head or couer of the Rough artery. The whole body of it is almost all gristly, for being the Organ of Breathing it was necessary it should euer be open whether we had need to take in fresh ayer or to breathe out old.

Againe, it is the Organ of the voyce which is nothing else but a percussio of the ayre, Now the ayer is not broken but at a solid, hard, and light body. It consisteth of three gristles or rather of foure, which are so fastened together that by them it may easily be dilated and constringed: shut and opened. The first is called *Thyroides* the shield-gristle, because it is like a square shield such as is carried before Tilters in their triumphs; and this is sometime double, especially in women, in whom likewise it buncheth not out so far forward as it doth in men. The second is called *Crycoides* the Ring-gristle, for it is wholly circular and keepeth the pipe open. It preuenteth also the compression of the rest of the semicircular gristles in the motions of the Larinx. The third is called *Argyranoides*, or the Ewre-gristle, because it is like an Ewre with which we vse to powre water vpon mens hands, or rather it hath this denomination from the similitude it hath with an oyle cruise.

The first Anatomists accounted this gristle single, but those that haue come since haue found it to be double, and that the parts thereof are connected or knit together with membranes or with ligaments. And indeed these parts thus ioyned do make the *glottis* or cleft of the Throtle. The opening or closing of these parts make the voyce base or treble, but the *Epiglottis* striketh a great stroke in it as it shurteth his cleft more or lesse. *Columbus* saith that these gristles do sometimes turne to be bones and instances in a notable Fellow who could not be hanged. And thus much of the Larinx, now we proceede to the rough Artery.

The *Weazon* because it is a vocall Organ or wind instrument, fistulated or made hollow to leade ayer vnto the Lungs and to returne out of them fumid vapours the recrements of the spirits, it was for the greatest part made of gristles, and thence it is called *καρχία*, *Arteria aspera* because it is asperated or made rough and vnequall with gristlie rings. Now a gristle is the fittest instrument of the voyce because it is of a middle nature betwixt hard and soft, for soft things because of their weaknesse do strike the ayer more remisly, and hard things doe easily ouerturne it.

These gristles are like rings, not round rings, for on the backpart where they touch the gullet they end into membranes, so that they are but semicircular like the letter C, from whence also they are called *αργυροειδεις*. These gristles saith *Laurentius* doe not onely runne as far as the Iugulum as some haue dreamt, but throughout the whole course of the artery they are in all his branches that passe into the whole flesh of the Lungs, an obseruation which few men haue made triall of.

The reason why these gristles were not made perfectly circular, I thinke was, as well that the Gullet should not be hurt with the hardnesse of the artery, as also that we might swallow the more freely, for oftentimes we swallow hard and vnbroken bites which would out of doubt offend vs vnlesse the artery did yeeld vnto the Gullet.

It may be objected that the body of the Larinx or Throtle is wholly gristly, and yet it hindereth not the Gullet.

But there is a great difference betwixt these, for in deglutition er swallowing the Gullet is drawne downward but the *Larinx* runneth vpward, so that the situation of those

The gristles
of the Larinx.

The Weazon.

Why gristly.

Why the
rings are not
round.

parts is changed, and the beginning of the Gullet approacheth vnto the rough artery, but the throttle ascendeth as high as to the chops.

Moreouer, these gristles are semicircular, onely in the vpper part, as low as in the *Ingu- lum*, but when they are past the *Oesophagus* and come vnto the Lungs, they grow round, because it was necessary that the artery in the Lungs should be kept open for the freer tra- cion and expulsion of the aire. He that desireth further satisfaction concerning the nature of these gristles, let him repaire to the 18 chapter of the first booke.

CHAP. IIII.

Of the Gristle in the Trunke or Bulke of the Body.

The gristles
of the Spine.



He Gristles that are in the Bulke of the Body, are either in the rackebones of the Spine or in the Chest. In the Spine there are many Gristles to establish the articulation of the Spondels, and to make their motion more facile and easie. All the *vertebrae* of the necke haue Gristles aboue and below, excepting the first, so is it likewise in the backe and in the loynes. But those of the Holy bone are harder and dryer then the rest, because the whole bone is immouable.

The extremity also of the Holy-bone is gristly, and is called *Coccyx*, or the Rumpe. It carryeth the figure of a Corner, or paper, wherein Grocers vse to put vp their Spices, sa- uing that the cone or sharpe end is somewhat beaked or crooked. This establisheth the right gut, as also the necke of the wombe and the bladder, and when women are in travell, it is bent backward, not without very great paine.

Of the gristles
of the Chest.

For the chest it behoued well that some part of it should be gristly, that it might more follow our inspiration and expiration. First therefore there are two gristles which ioyn the clauicles to the brest-bone. Then the *Sternum* or brest-bone hath a gristle in the vpper, and another in the lower part. In the vpper part betwixt the first and the second bones which serueth instead of a ligament, but below appeareth that notable gristle which they call *Xiphoides*, or the brest-blade. The forme of this gristle is very diuers, for it is not alwayes acuminated or pointed; but sometimes broad in the end, and sometimes tynd or diuided into two forkes, and thereupon some haue called it *Furcella* the little *Forke*. Of- tentimes, saith *Laurentius*, we haue seene it round like the *Epiglottis*. Sometime the parts are vnequall, and the lesser lyeth ouer the greater, like the leafe of the herbe which we call Horfe-tongue, about the middle of it, it is perforated with a small hole which few haue obserued, made to transmi a nerue and a veine.

The brest-
blade.

The vse of it.

The vse of this gristle is the same with other gristles which hang at the ends of bones, to wit, by yeelding to breake the violence of outward iniuries, and to defend the parts subie- cted thereunto. Some thinke it was made as a defence for the midriffe which in that place is nervous; some to safegard the mouth of the stomack; hence say they, often comes a *Nau- sea*, or loathing of the meat, when this gristle is bent inward and presteth the mouth of the stomack. Some of the *Neotericks*, or new writers, do deride this latter vse, because say they there is a great distance betwixt this gristle and the mouth of the stomack, which is appli- ed to, or leaneth vpon the back; but *Laurentius* saith, it is false that there is any such distance in living bodies, for first, they that vomit much when they are about to cast, doe find a paine at this gristle.

Againe, *Hippocrates* in the third section of his booke *De Articulis*, hath remembred such a distention of the stomacke, to the foreparts where he saith, *That the repletion of the belly* (he meaneth the stomacke) *is a direction for broken ribbes*.

Moreouer in *Coacis*, he calleth the mouth of the stomacke *Sternum*, where he speaketh of the bitternesse and gnawing of the *Sternum*, that is, of the mouth of the stomacke; but aboue all, that is absurd, and an old wifes fable, who say that this gristle sometimes fals away and may be replaced againe by muttering a peece of the *Mattens* ouer it, and by attraction or groping vpon it.

Two gristles
in each rib.

Finally, euery rib hath two gristles, one on the backe-side where it is articulated to the spondell: another on the fore-side, by which it is ioyned to the brest-bone. But the for- ward are greater and thicker then those that are backward, because the fore-part of the chest is distended and contracted. The gristles also of the bastard ribs are longer then those of the true ribs. And so much for the gristles of the trunke.

CHAP. V.

Of the Gristles of the Ioynts.



Here is almost no Ioynt in the whole body of Man, but for his more-secure and facile motion, it is crufted ouer with a Gristle, as partly we haue shewed before in particular. Moreouer, in the cavity or hollownesse of the shoulder-blade, Nature placed a Gristle to increase the *sinus* or bosome of the bone, lest in violent motions the ioynt should be easily luxed or put out.

In the lower part of the Cubit which hath an acute or sharpe processe, there appeareth a gristle which filleth vp the empty distance. It hindereth the hand when it is led to the side from offending against that acute processe. Betwixt the share-bones there is a thicke and hard gristle so vniting them together, that it is not credible they should be seuered in the time of trauell, as we haue shewed before in the 33 Question of our first book. In the cavity of the hanch-bone there is another gristle which increaseth the compasse of the bosome or cavity therein.

Finally, in the lower heads of the thighes we finde two semicircular gristles which enlarge the lips of the cavities. In a word almost euery articulation is crufted ouer with a gristle to make the motion more easie, more secure and more permanent: and so much concerning Gristles. Now we proceed vnto the Ligaments.

The second part of Ligaments.

CHAP. VI.

Of the Nature, vse, and Differences of Ligaments.



As the lubricity of Gristles makes the motion of the Bones more nimble and quicke: so the Ligaments doe secure both motion and articulation: but there is a double acception of a Ligament, the one large, the other presse and more restrained. In the first sense we call any thing a Ligament, which tyeth one part to another. So Hippocrates calleth the skin and the flesh *colligations*, the ancients also called all manner of vessels, veines, arteries and sinewes, *common Ligaments*. In the presse and strict signification we call that a Ligament which is a hard and firme body, yet lax and flexible and without sense, which incompasseth, tyeth downe and containeth the ioynts.

This kinde of Ligament properly so called, the *Grecians* call *σύνδεσμος*, the *Latines* *copula*, *vinculum* & *Ligamentum*, we may call it a Tie; but because the word Ligament is grown into common vse, we will, if you please, retaine it for the most part. *Laurentius* giueth this definition of a Ligament. It is a similar cold & dry part, of a middle nature betwixt a nerue and a gristle (betwixt a membrane and a gristle, saith *Banrhine*) ingendred by the power of heat out of the slimy part of the seed, and being of great vse in colligation, containing, inuesting and forming of muscles.

Concerning the temper of a Ligament (which is the forme of a similar part) all men doe agree. It is cold and dry without question, albeit some peculiar ligaments of ioynts, are lined ouer with a mucous and slimy humour; but concerning those things which accompany, follow, and happen to the temper, many haue made scruple: hardnesse and softnesse follow the temper, sense and motion happen vnto it. We resolute that Ligaments are of a middle nature, betwixt gristles and membranes: harder then membranes, lest in vehement motions they should be broken, and softer then gristles, that they might more easily follow and obey the muscles which moue the bones. For the most part they are all insensible, as well because they receiue no nerues into them, as also lest being perpetually moued they should breed perpetuall paine.

It may be obiected, that *Galen* in his third booke *de facultat. natural.* saith, that Ligaments consist of sensible fibres; but we must know that by *sensible*, in that place, *Galen* vnderstandeth not that which hath sense, but that which is liable to sense, not that which is sensatiue but that which is sensible. For Ligaments borrow nothing of the braine, and therefore haue no sense, neither can they moue themselues; notwithstanding as among the bones, the teeth haue sense, among the gristles those that make the eye-lids; so amongst the Ligaments there are some which haue the sense of touching, as the two ligaments that make the yard, and the reyne or bridle of the tongue.

A double acception of a Ligament.

The definition of a Ligament.

Obiection Solution.

The matter
of Ligaments.

The matter of Ligaments is the slimy part of the seed extended or lengthned by heat, whence it is that they can be contracted and againe relaxed. Their Aliment I doe not take to be (saith *Laurentius*) as some would, marrow, but bloud conuayed vnto them by *Capillary* veines, which are so little that they cannot be perceiued.

Their vses.

The vses of Ligaments are diuers, the first and most common is to firme and assure the articulations, especially those that are more laxe of the bones and the gristles and to hinder luxation, for it was to be feared that when the bones are separated in violent motions they should be also distracted, vnlesse the wisdom of Nature had provided to tye their extremities together with strong and strait bonds. These Ligaments which performe this vse are either common which compasse the ioynt round about, or priuate. The common are thin and membranous, the proper are thicker and most what round.

2 Their second vse is to bind and fasten the bones where they are not articulated, for there are thinne and fine Ligaments which tye the cubit to the *Radius* and the Legge to the *Brace* where they gape asunder, as also the spines of the spondels.

3 The third vse is that which *Galen* remembreth, who saith they serue for an outward garment to defend the tendons. So the tendons which bend and extend the Fingers and the Toes are throughout their whole length covered with Ligaments and with membranes.

4 Adde hereto the fourth to containe the Tendons in their owne places, to establish them and safely to transmit them from one place to another. Such are the Transuerse Ligaments of the wrest, round like a ring and therefore called *Annularia*.

5 Fiftly, they are interposed like a pillow betwixt the bones and the Tendons, that the hardnesse of the bone should not offend the tender and sensible tendons.

6 Sixtly to discriminate or separate the right muscles from the left, the fore muscles from the hinder, and other parts one from another, as we may see in the Ell and the *Wand*, in the Leg and the *Brace*.

7 Seauenthly, to encrease and augment (as do the gristles) the *Cups* of the bones.

8 Eightly, to suspend the bowels that they should not fall with their great waight. Such are the Ligaments of the Liuer, the Bladder and of the Wombe.

9 Finally, they concurre vnto the structure of a muscle, for of the fibres of a nerue and a ligament mixt together is a tendon made.

The differences
of ligaments.

The differences of Ligaments are to be taken from their substance, magnitude, figure, site, originall, insertion, vse, and from their principall parts. From the substance some are soft, some hard, some membranous, that is, like vnto membranes, because they be broad. Some are neruous, that is, round like nerues; some are gristly. From the magnitude some are little some are great, some are broad and some are narrow. From the figure some are broad some are round, some are continual, some are proforated, some are transuerse and annular, and some are long and direct. From the situation they are supernall infernall, right left, fore and backe Ligaments.

From their originall and insertion their diuision is very elegant, some arise from bones, some from gristles, and some from membranes. Those which arise from bones are inserted either into a bone or into a gristle, or into the heads of muscles, or into some other part. Of those which arise from a bone and are inserted into a bone, some do firme the ioynts, others tye the two bones together without a ioynt, others defend and inuest the tendons. Those which arise from a bone and are inserted into a gristle doe appeare in the knee, one from the internall roote of the inner *Cup*, the other placed vnder it. Those that are inserted into the heads of muscles are very diuers, some grow out of bones and runne into other partes, as that double Ligament which maketh the greatest parr of the yard, and ariseth out of the share-bones. Those Ligaments that arise out of gristles are some of them inserted into gristles; such are they that tye together the gristles of the *Larynx*; they that are in the end of the Rump and those that tye together the halfe circles of the Rough artery; others are inserted into the heads of muscles, as those that runne into the vpper muscles of the *Larynx*. Those Ligaments that arise from membranes are but few.

From the vse you may gather diuers differences of Ligaments according to the vses before named.

Finally, from the principall or more notable parts of the body we may very fitly deuide Ligaments into those of the Head, those of the Chest and Backe, and those of the Ioynts, according to which diuision we will now prosecute their particular History.

CHAP. VII.

Of the Ligaments of the Head.



He Ligaments of the Head doe some of them belong to the whole Head, some to particular parts thereof: the whole Head is moued about the first and the second *vertebra* or spondell of the necke, wherefore it was needfull that it should be fastened with strong ligaments, otherwise a notable part had been in danger of luxation. Of these Ligaments *Bauhine* reckoneth foure, *Laurentius* but three, which notwithstanding (saith he) may be diuided into more particles.

The ligaments of the head.

The first is a very great and broad Ligament which tyeth the first racke-bone vnto the Head and compasseth the whole ioynt round about. It hath two portions, one like a thicke membrane, and runneth to the inside of the first spondell, the other part compasseth about the outside of the ioynt. It ariseth out of the *Basis* of the *occiput* or Nowle of the Head, which is therefore exasperated, and in yong children is scotched or cleft manifold: hence it is, that the first and second *vertebra* may sooner be broken then luxated.

The first.

The second Ligament fastneth the proesse of the second Rackebone called the *Tooth* to the head, and it consisteth of three parts. Two arising from the outside of the *Tooth*, are inserted into the inside of the circumference of the hole which is in the Nowle-bone. The third is round like a nerue, and ariseth from the foreside of the *Tooth*, and is infixed likewise into the hole of the Nowle, to which it adhereth very strongly.

Second.

The third Ligament is very like a nerue and made with wonderfull art, and compasseth the cavity of the first Rackbone which was made to receiue the *Tooth* of the second, and constringeth the said *Tooth*, so firming it that it cannot incline to either side; it safeguardeth also the spinall marrow, lest it should offend against the bare bone.

Third.

The fourth Ligament ioyneeth the second Racke-bone to the first. It is membranous and of the same nature and vse with the other ligaments of the ioynts; and these are the common ligaments of the head. There are also other proper ligaments in the head, which belong to particular parts: as the ligament of the gristle of the Eare: a strong ligament, for it fastneth the root to the stony-bone, and ariseth with diuers propagations from the *Pericranium*, where it tendeth toward the *Mammillary* proesse. These propagations when they come vnto the eare doe grow together into one ligament, and it is inserted into the vpper and gibbous part of the eare to hold the gristle pricked vp and suspended.

Fourth.

Of the ligament of the eare.

There is a ligament also in the eye, called by *Falopius*, *Ligamentum Ciliare*, not because it is of the nature of a ligament, but because the grapy coat is thereby fastned to the verge or circumference of the membrane of the *Christalline*, but we haue spoken of it sufficiently before in the end of the seuenth chapter of the eighth booke.

Of the eye.

The Ligaments of the vpper law, betweene the *sutures* and the *harmonies*, are thinne and membranous, made for the originall of the muscles, for from them the tendons of the muscles of the Face and of the neighbour parts take their originall. The articulation also, (saith *Galen* in the 20 chapter of his first booke *De usu partium*) of the lower law with the Temple-bones hath strong ligaments, which *Bauhine* out of *Platerus*, calleth a common membranous ligament incircling the whole ioynt.

Of the law.

The ligament of the tongue *Galen* discourseth of in the 10 chapter of his 11 booke *De usu partium*. It is strong, membranous and broad, but of it we haue spoken before in the 32 chapter of the 8 booke. Of the ligaments of the bone *Hyois*, we shall speake in the booke of Bones. Of the ligaments in the Heart, in the rough Artery and the cutany ligament of the wombe, we haue spoken before in their proper places, which we will not now stand to repeat, but proceed on vnto the ligaments of the Spine and the Chest.

Of other parts.

CHAP. VIII.

Of the Ligaments of the Spine and the Chest.



He motions of the Spine are very diuers, and therefore the Rackebones stood need to be fastned together with ligaments. In these Rackbones we may obserue their bodies and their proesses. In like manner there are two sorts of ligaments, one kind fastneth the bodies of the spondels, another their proesses, and these saith *Bauhine* are of two sorts, the one is strong and mucous, which compasseth the bones and fastneth the whole length of the Spine; in violent motions downewards, and in great burthens securing it from danger.

Ligaments of the Spine.

The

The other sort is gristly, and *Galen* indeed in his Booke *de ossibus* calleth them Gristles, which kind goeth betwixt the bodies of the spondels and fastneth them strongly together. It is fibrous and mucous, thicke without, but toward the middest attenuated, and carieth the very forme of the spondell, answerable to it in breadth and length, and determineth into the gristle which is betwixt the spondels. The ioyntes of the processe are also fastned with common membranous ligaments, the ascendents with the defendents. Furthermore there is another priuate or particular Ligament and yellowish, arising out of the inside of the hole of the Rack-bone at the roote of the backward processe betwixt two ascending or descending processe, and is againe inserted into the same place of the subsequent spondell.

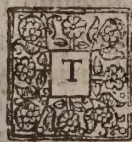
In the necke of a Dogge we meete with a Ligament which is rare indeed but strong and yellow, and cannot be parted into fibres. It groweth out of the very top of the spine of the seventh Racke of the necke, and ascending vppward free and at liberty is fastned into the top of the second spine of the necke. In sheepe it groweth to the Nowle-bone. In beastes of burthen it is very thicke for more strength, and of all the Ligaments of the body is refused for meat; yet saith *Vesalius* some commend it to be eaten to make the haire grow long. It may be (saith he) because it is easily dissolved as it were into yellow haire. In some creatures throughout the length of the backe runneth a Ligament on each side betweene the muscles that moue the backe, which saith *Vesalius*, *Galen* also attributes to men in his booke *de usu partium*.

Of the Chest.

The Chest also hath his Ligaments for all the ioynts thereof are ioynd with common membranous Ligaments compassing them about. So the ribbes are fastned to the spondels with strong and almost gristly Ligaments, especially the first and second rib because of the burthen which they were to beare; likewise the twelfth, because it is not sustayned with a transuerse processe. The same ribs are ioynd by the mediation of Ligaments of the gristles of the brest-bone. The bone also of the Brest it selfe is fastned to the clauicles by the interposition of a proper Ligament.

CHAP. IX.

Of the Ligaments of the Shoulder-blade, the Arme, the Cubit, and the wand.



THE head of the Arme being round that the whole Hand might moue speedily every way, & the cavity or *Cup* of the Blade being but shallow; (as whose browes are narrow) least in the diuers morions the Arme should be luxed, Nature partly by two recurued processe of the blade, partly by Ligaments which defend the ioynt, hath provided for so desperate an inconuenience.

Five ligaments of the arme.

These Ligaments are five. The first is *Broad*, so *Galen* calleth it, and membranous like the Ligaments of other ioynts. It taketh his originall circularly out of the verges or browes of the necke of the Blade, incircleth the whole ioynt about, and is infastned on the inside of the beginning of the head of the Arme, and implanted into the outside of the head and into both their neckes.

The second is perfectly round, as also is the third, and groweth from the top of the *interior* processe of the Blade, and compasseth about the inside of the vtter head of the Arme whereto it groweth very strongly.

The third is thicker and greater then the former and ariseth out of the vpper part of the necke of the Blade, and climbing over the head of the arme, is inserted into the outside thereof, where at his cavity the outside buncheth out somewhat, so that these two Ligaments together make as it were one transuerse Ligament.

The fourth is broad also and issueth out of the same place with the third. His originall is large, and runneth obliquely till it be infixed into the backside of the vtter head of the Arme where it compasseth the backepart of the ioynt as did the first.

The fift issueth from the *anterior* processe of the blade and runneth vppward to the top of the shoulder.

The vse of these Ligaments is; of the first the same with the Ligaments of other ioynts; of the three next to keepe the arme that it fall not downeward or outward out of his socket. Of the fift to keepe the arme from luxing forward, in which seruice it is holpen by the outward head of the double headed muscle.

For

For the Cubit, although throughout his length all the muscles are compassed with a strong membrane which fasteneth them together, holdeth them in their places, and like a transverse ligament as it were bridleth them vp growing to them very strongly and closely as the proper membrane of a muscle doth; yet there are other ligaments which ioyne the bones together. Wherefore the cubit, which is compounded of the Ell and the Wand, hath ligaments whereby it is fastened to the arme, to the wrist, and also the two bones of the cubit together. To the arme it is fastened with common ligaments, strong but membranous, which tye the Ell to the arme & the wand to the vpper protuberation of the arme. But to the wrist it is articulated with a membranous ligament common to other ioynts, and beside with two proper round ligaments, one fastened to the Ell which runneth from the proesse called Styloides vnto the fourth bone of the wrist and is more gristly then the rest; the second fasteneth the wand to the wrist, for it issueth out of the top or pitch of the wand and runneth into the wrist.

Againe, these two bones of the Ell and the Wand are vaited by a common ligament aboue and below, as also by a peculiar which is membranous and strong running throughout the whole length of both bones, for his situation is in the distance betwixt them, arising from an acute line of the Ell, and inserted into a line of the Wand. It hath also oblique fibres which creepe downward obliquely from the Wand vnto the Ell.

The vse of this ligament is to conioyne and fasten these bones together, to distinguish the exterior muscles from the interior, as also to afford an originall to some muscles, or, at least to adde strength to their originals.

The ligament of the Cubit.

The ligament of the wrist.

Their vse.

CHAP. X.

Of the Ligaments of the Wrist, After-wrist, and the fingers.



THE bones of the Wrist haue common Ligaments with which they are in a manner inuested, for somtimes and in some places they get betwene the bones and become gristly. This common ligament issueth from the lower appendix of the Ell and the Wand. It is very strong and so fasteneth the bones that they become fit for their proper motions which are indeed but obscure, for they are implanted into the appendix of the bone of the After-wrist.

The bones also of the After-wrist are fastned together by common ligaments, which doe not onely compasse the bones orbicularly, but also, neare their extremities in the middle where the bones doe meete one with another they insinuate themselves, becomming of the nature of a gristle, so as they passe againe outward and ioyne the bones of the After-wrist to the wrist.

Finally, the knots or knuckles of the fingers are fastened together with common Ligaments, besides which there are yet in the hand other ligaments which do not serue to articulate or ioyne the bones, but do onely incompasse and containe the tendons that go vnto the fingers, least when they are moued they should slippe out of their places. This kind of ligament is double, one at the inside of the wrist like a bracelet on the inside especially, and holdeth together all the tendons that fall downe to the hand: from it also somtimes proceedeth the tendon of the muscle called *Palmaris*.

The other ligament is on the outside where the wrist is articulated to the Cubit. It taketh his originall from the two forenamed appendices or out-shootes, and is spread over the whole breadth of the Cubit. At the first sight it seemeth to be but one, but when it is dissected it appeareth to be six transverse ligaments, which like Rings are shot ouer the tendons of the muscles that extend the fingers, whereby those tendons are contained or fastened together.

The first proceedeth out of the Ell into the Wand and runneth vnto the Sinus or cavity which is common to them both and is peculiar to the sixt muscle that extendeth the fingers.

The second belongeth properly to the Ell and to the first extending muscle of the wrist.

The third is proper to the Wand and to the extending muscles of the forefinger, the middle finger and the Ring-finger.

The fourth is an exceeding narrow Ring belonging to the slender tendon of the muscle that leadeh the fore and middle fingers from the thumbe.

The fift maketh a way for the second extender of the wrist, and for that muscle which turneth the thumbe toward the forefinger; sometime also a peculiar ligament couereth the tendon of the Thumbe.

Finally,

The ligaments of the wrist.

Of the after-wrist.

Of the fingers.

6 transverse.

Other liga-
ments of the
fingers,

Finally, the fixt transmitteth the three tendons of the second muscle that extendeth the Thumbe.

Moreover, every finger hath ligaments which run throughout their length, arising from the sides of their inner bones which are long and like canals; these do containe or keepe the tendons that bend the fingers in their cavities, least in the flexion they should strut vp out of their place or goe astray.

To conclude, there are other membranous Ligaments, or rather mucous membranes, but redder then the other membranes of the Tendons, which after the manner of Ligaments couer the Tendons that are transmitted to the hand and the fingers, involuing them for their more security, from which sometimes the muscles take their originall, and so much of the Ligaments of the Hand.

CHAP. XI.

Of the Ligaments of the Holy-bone, the Hanches, and the whole Legge and Foote.

IT remaineth now that we proceed vnto the Ligaments which tye the Hanch-bones and bones of the Coxendix and Holy-bone, as also those that fasten the share-bones and which belong vnto the legge.

The lig. of
the hanch.

The ligament which tyeth the hanch bone to the holy bone is a common ligament, broad, membranous and strong, yea in that part where it goeth betwixt the bones it seemeth both in strength and thickenesse to be gristly, the better to constringe and fasten that loose coniunction. Hence it is saith *Bauhine*, that in the travell of a woman, if the impression or throae be more violent, the connexion will yeeld somewhat.

Of the Holy-
bone.

That which tyeth the holy-bone to the Coxendix is double, one ariseth out of the coniunction of the fift and sixt holy bones, and is infixed into the acute proceffe of the Coxendix; the other ariseth indeed out of the same place, but is inserted into the posterior part or appendix to fasten the bones the stronger together. Anatomists also do conceiue that this ligament was ordained to sustaine the right gut with his Muscles vnder which there is no bone.

The share-
bones.

The share-bones although they be fastened together by the interposition of a gristle, yet haue they a double Ligament, one which compasseth them about circularly, least in the travell of the birth, or other great and strong motions of the thigh they should be broken, which might well haue hapned if there had bene nothing but bones to hold them. The other ligament is that which occupieth the perforation, membranous it is and consisteth of fibres that run obliquely downward, for because it was fit that the share-bones should be light, a great part of it is (as it were) turned out; and a ligament substituted as well to sustaine the Muscles that belong to the bone, as to distinguish the two *Obturator*s or the ninth and tenth muscles of the thigh.

Of the leg.

The ligaments of the legge are threefold. Some are referred to the articulation of the thigh, others to the articulation of the legge, and others to the articulation of the foot. The thigh is fastned to the ioynt of the Coxendix by a double Ligament, one common and membranous which circlet the ioynt, and this the Grecians call *ισχιον*, by the name of the whole ioynt, because it is much thicker, harder and stronger then other Ligaments that passe the ioynts; which strength was well provided by nature, for the motions thereof are very strong, and besides it sustaineth the whole body. This Ligament lieth vpon the ioynt and the necke of the thigh, but groweth onely orbicularly to the roote of the great proces that the motions of the head of the thigh might not be hindred. The other ligament of the Thigh is round, and because of his hardnesse may be called a gristly nerue. It is seated in the cup of the Coxendix, and ariseth out of the depth thereof where the cavity is lined ouer with fat to make the head mooue more glib, and where the brow or brim of the cup ceaseth: and is inserted into the middest of the head of the thigh on the top thereof, that it might not easily fall out of the socket; for the thigh is heavy, and hangeth, as it were downe from the Coxendix, wherefore when this ligament is laxed and becommeth longer, luxation oftentimes ensueth, yea sometimes it is broken, and although the bone be restored, yet the patient is alwaies lame after, because the two bones do not adhere so close as they did before.

Of the thigh
two.

The first.

The second.

Next

Next follow the Ligaments of the Legge and the Brace. The first Ligament of the leg is membranous and common, which compasseth the whole knee, except that part which the whirle-bone together with the tendons containing it doth occupy, for that is sufficiently constringed and contained by them.

The ligaments of the Legge.

The other is seated in the backside or in the inside of the knee; strong it is and neruous and groweth out of the proceffe of the legge, and being forked or tined, is fastned vnto the lower head of the thigh on either side. The third is exceeding strong and gristly, growing out of the prominent part of the legge betwixt the cauities thereof, and is inserted into a middle canale or bosome betwixt the two heads of the thigh on the backside. The fourth is slender and mucous in the middest of the ioynt of the knee, and runneth vp from the leg into the thigh, but is not to be found in all bodies. The fift is thicke and almost round, couering the outside of the knee, and it fastneth together the bones of the thigh, the Brace, and the Legge. The sixt is yet smaller then the fift and softer, and is fastened to the inside from whence it ariseth, running obliquely vnto the foreside of the leg.

The Legge also is fastned to the Brace, first by a common Ligament in the vpper part neere the ioynt of the knee which embraceth the connexion of the bone on the outside. Againe in the lower part they are ioyned with a common membranous ligament which proceedeth from the legge vnto the Brace which it tyeth thereto.

Moreouer, betwixt the bones of the legge and the Brace; the space is occupied or taken vp by a Membranous peculiar Ligament which groweth throughout the length of the Brace very fast vnto it. Notwithstanding his originall seemeth to be, by the course of his descending oblique fibres, from the leg-bone, and his insertion into the Brace. By the Ligament not onely the bones are conioyned, but also the muscles which occupye the leg are distinguished the forward from the backward, and it also affordeth a strength vnto the originall of these Muscles that grow vnto it.

The Ligaments of the foote are very many, whereof some do containe the tendons transmitted into the foote and the toes, and they are three transuerse, others fasten together the bones of the foote. The first is situated before at the ioynt of the foote with the legge, which fastneth the bones together and transmitteth some Tendons of the Muscles. The second ariseth from the bone of the legge or from the inward ankle, and is inserted into the bone of the heele, and this Ligament maketh three rings, as it were three Ligaments, because there are three cauities for the tendons of the bending muscle of the great toe & of the great bender of the other toes which passe that way. The third ariseth from the outward ankle or from the Brace and is implanted into the heele, it helpeth the Coniunction of the bones, and couereth two cauities to transmit vnder it the Tendons of the two Muscles called *Peronai*, as we haue shewed before in the History of the muscles. The vse of these Ligaments (as is it in the wrest) is, first of all to add strength to containe the tendons of the muscles of the foote that they be not moued out of their places; from these Ligaments also those tendons do receiue a portion, by helpe whereof they are produced or lengthned together with the small strings of the Nerues. In like manner in the lower side of the toes we finde transuerse Ligaments such as are in the Hand, that containe and establissh in their office the tendons of the muscles which bend the second and third ioynts of the fingers. These Ligaments do fasten the bones of the foot, and are referred to the instep, to the wrest, the afterwrest of the foote, and to the Toes. *Platerius* addeth those, a broad Membrane coupling together many Muscles in the Leg, and the Ligament in the soale of the foote, which serueth instead of a tendon.

Of the Foot,

Their vses,

There are also Ligaments which binde the *Talus* or pastorne-bone (for so it is called in Beasts, we call it commonly the Cockall) either to the legge or to the bones of the foote; the first of those that binde the *Talus* vnto the bones of the Legge is common and Membranous and compasseth their articulation, the rest are all gristly. The second ariseth from the inside of the *Talus* where it is receiued by the inner ankle, and is inserted into the Legge bone where it regardeth the *Talus*. The third ariseth from the outside of the *Talus*, and is fastned into the Brace-bone that regardeth the same.

Of the Talus.

The Ligaments that fasten the *Talus* to the bones of the foote are five, the first is common and membranous and compasseth the iuncture of the *Talus* with the heele; and this *Vesalius* maketh the fift. The second is stronger and gristly and ariseth from the lower part of the *Talus* neere his neck, and is inserted into the heele betwixt the two commissures therof with the *Talus*. This Ligaments *Vesalius* accounteth for the third.

The

The third Ligament (*Vesalius* calleth it the fourth) is gristly likewise, and compasseth the whole ioynt on the outside. It ariseth out of the necke of the *talus*, and is fastned to the bone which is like a Boat. The fourth is strong, arising from the necke of the *talus*, and is implanted into that bone which we call the *Dy* or the *Cube*. The fift is strong and gristly, ioyneeth the bone of the Heele vnto the *Cube*, and encompasseth the ioynt round about.

The Wrist.

The bones of the wrist of the foot, are coupled with very hard and gristly Ligaments, either among themselves, or to the bones that border vpon them. To the neighbour-bones, as on the backside the *Cube* or *Dy-bone*, to the necke of the *talus*, and the same vnto the Heele, so three bones are fastned to the Boat-bone, and on the foreside to the bones of the After-wrist. They are ioyned one to another, as in the vpper part or backe of the foot. In like manner in the lower part there is a very strong and peculiar Ligament, which fastneth them on the outside, and tyeth also the hindparts of the bones together, because it insinuateth it selfe among them.

The After-wrist.

Finally, the Ligaments of the After-wrist and the Toes which ioyne them together, are answerable to the Ligaments of the hand, both in their passage and conformation: those also which run in the distances betweene the bones of the wrist are gristly, the rest are membranous. *Archangelus* addeth, that there are common Ligaments which bind and fasten the particular ioynts of the toes, as it is in the ioynts of the fingers. And thus much concerning Ligaments.

The third part, of Membranes.

CHAP. XII.

What a Membrane is, their Uses, and Differences.



Definition of
a membrane.

of the seed, and therefore broad, thin and fast, the organ of the sense of touching, keeping, knitting and separating the partes vnder it.

By the common consent of *Hippocrates*, *Galen*, and almost all Physicians, *μεμβρανή*, a Membrane and a Coat doe signifie one and the same thing. I know there is sometimes some nice difference amongst the *Grecians*, but it is of no great consequence, and therefore I would haue you to vnderstand me to meane the same thing, when I speake of a Coat, and of a Membrane. The definition of a Membrane is much more necessary, which *Laurentius* hath on this manner: *It is a similar part, cold and dry, engendred of the slimy part*

That it is similar it is manifest, because it is vniforme, and though it be wouen with fibres, yet are they not conspicuous. I speake here of true Membranes not of membranous bodies, such as are the wombe, the bladder, the stomacke, the guts, and such like, which make a part in themselves, and wherein all the three sorts of fibres doe appeare. That it is cold and dry, *Galen* teacheth in his booke *De temperamentis*, but yet it is lesse cold and dry then a Tendon, a Ligament, a Gristle, or a Bone: but more cold and dry then Arteries, Veines and Sinewes. The matter of Membranes is the slimy part of the seed, which by the power of heat is stretched or distended; whence it is that a Membrane may easily bee dilated or compressed without danger: onely the Membrane, saith *Galen*, may be safely distended and contracted, and therefore all parts which were to be distended and contracted, are made membranous. A membrane is broad and extensible to inuest and preserue the part: thight and fast for strength, and beside that it may not so easily receiue an influxion of humours, yet thin, lest the weight of it should be offensive. Notwithstanding though it be thin and appeare simple, yet euery Membrane is double; through which duplicature there run veines for nourishment, arteries to conuey life, and nerues to conuey sense, which vessels being slender and fine, it was fit they should be conueyed betwixt two coats.

The organ of
Touching.

The common office of a Membrane is to be the organ of the sense of Touching, as the eye is the organ of Seeing, and therefore the sense of a Membrane is most exquisite. A Nerue is indeed the conueyer of the spirits and carrieth downe the Commandements of the soule; but as in a muscle it is not the primary organ of motion, as in the eye it receiueh not visible objects, so it doth not receiue the first tactiue qualities, onely the Membrane

brane is it which we must esteeme the organ of Touching; and if you despoile the parts of their membranes, you make them also insensible. Hence it is that the flesh of the lungs, of the liver, of the spleene, and of the rest of the bowels is insensible. As therefore the sense of Touching is diffused throughout the whole body of the creature because it is euery where necessary: so likewise are there membranes sprinkled through the whole body almost internally and externally. On the outside the body is inuested with the skin and the fleshy membrane. On the inside the peculiar membranes are almost infinite.

If it be objected out of *Galen in arte medicinali*, that membranes haue onely inbred nor influent faculties such as is sense. We answere with the Reconciler; that *Galen* then speaketh of membranous and broad ligaments which issue from the bones.

Objection.
Galen ex-
pounded.

The three last particles of the definition do elegantly expresse the three principall vses of membranes. They inuest the parts vnder them like a couering, whence they haue the name of coates. They conserue the fibres to make the flesh more firme and stable, they containe the substance of the parts and enclose it round about least it should dissolue and separate part from part.

Moreover, they fasten one part to another, from whence proceedeth the admirable sympathy or society of the parts. So by the *periostia* the bones are al continued one to another; by their common membrane all the muscles are vnited: by the skin the whole body hath his connexion though it be diuers in respect of the structure of parts which are of diuers kinds. Finally, by the helpe of membranes parts are separated from parts, as we may perceiue in our sections of muscles.

The vses of
membranes.

There are other peculiar vses of membranes, to sustaine parts as appeareth in the *Mediastinum*: to hinder the refluxence of humor as the values that are in the heart, in the great veins and such like places, and to leade along and establish the vessels that are to be distributed into other parts, as into the mesentery, the kell, and the fleshy membrane.

The differences of membranes are manifold and are taken from their substance, magnitude, site, figure, conformation or texture, and from the nature of the parts which they inuest or containe. If you regard the substance which is the Mansion-house and Ancient seate of the determinate and particular faculty, then we say that membranes are either lawfull and true or illegitimate. Those are true membranes, to which the definition before giuen will agree, such are the membranes or Meninges of the braine, the *Peritoneum*, the *Pleura*, the *Periostium* and such like; Illegitimate membranes may more truly be called membranous bodies. Of these there are three kinds, some arise from the bones, are broad and insensible, and fasten the ioynts together. Such are called Ligamentall membranes or membranous ligaments. Others are made of the tendons of muscles dilated and so become more like a membrane then a tendon, such are the thin ends of the oblique and transuerse muscles of the *Abdomen*, also the tendon of the muscle that leadeh the leg backward, which they commonly call *fascia latam* the broad swath. To the third kind I referre those membranous bodies which make parts by themselves, which although they be inuested with coates, yet are altogether made of membranous bodies. Such are the bladders of vrine and gall, the stomach, the guts, and the wombe.

The differen-
ces of mem-
branes.
The first:

Againe, those membranes which I called legitimate, are either of a thin or slender substance like vnto broad cob-webbes, such as appeareth in that membrane or coate of the eye that compasseth the Cristaline humour called *Arachnoides* or the cob-webbe coate; likewise in the *Pia mater* of the braine, and in the coates of the Lungs and the Liver; or they are thicke as the *Dura mater* and the membrane of the bladder; or they are fleshy as in the face, or altogether neruous.

From the magnitude some membranes are broad and some are long. The figure of membranes is manifolde according to the variety of the parts which they doe inuest. From the situation some are internall some are externall, some supernall, some infernall. From the context or conformation some haue fibres of all three kinds, some of two kinds, some of one kind onely: others are without fibres and may be torne euery way as paper may.

The second,
&c.

And so much of membranes in generall, of their Nature, vses, and differences. Now wee come vnto their history, and therein we will be but brieue, because we haue intreated of them almost all particularly in their proper places.

M m m m

CHAP.

CHAP. XIII.

A briefe enumeration of all the Membranes.



He number of Membranes is almost infinite, and we haue handled many of them before as they fell in our way in the order of Dissection, now we will gather them into a briefe sum.

The Mem-
branes of the
Embryo.

The Membranes thereof do some belong to the *Embryo* or infant before it be borne, others to the creature after it is borne also. The Membranes that inuolue the infant are three, called *Chorion*, *Amnios* and *Allantoides*: the *Chorion* is so called, either because it containeth the infant, or because it compasseth it like a circle or a crowne; it cleaueth wholly to the wombe by the interposition of the vmbilicall veines and arteries. *Amnios* or the *Lamb-skin* is the receptacle of the sweate. *Allantoides*, so called because it is like a Haggas-pudding is onely found in brute beastes, and couereth the creature not all ouer, but like a broad swath from the end of the brest-bone vnto the hips. Of these we haue spoken more at large in the 5 chap. of the 5 booke, and in the xvi. question of the Controuersies thereto belonging.

Of the Regi-
ons.

The Membranes belonging to the creature after it is brought forth, are vniuersall or particular. The vniuersall we call those which either do inuest the whole body, as the skin and the fleshy membrane: or all the parts of the same kind as the muscles and the bones. The Muscles are all couered with a Membrane which is common to the muscles, thin, nervous and fibrous, which some thinke, doth arise from the *periostium*: but *Bauhine* esteemeth it to take his originall from the sinewy fibres of the Muscles themselves; and it is fastned to them with thin and slender filaments. The vse of this membrane is to inuest and circumscribe the muscles, to separate them from the other parts and to giue vnto them the sense of Touching. The bones are all cloathed ouer from the crowne of the head to the soale of the foote with a membrane which they call *Periostium*, nervous, thin and very strong, yet we may except the teeth, the inside of the scull, and the ioynts of the Bones: of it we haue spoken in the third chapter of the seuenth booke.

The particular Membranes are such as doe inuest a particular region of the body, or one onely part. The Regions are three, the vpper, the middle, and the lower. The vpper Region is on the outside couered with the *Pericranium*, which is seated betwixt the fleshy membrane and the *Periostium*, arising as some say from the processes of the *dura meninx*, as others from Ligaments which passe through the futures of the scull, which Ligaments are stretched ouer that part of the scull against which they issue forth, and so meeting together are vnited into a common Membrane. Of this also we haue particularly entreated in the place last before named.

The Braine it selfe is couered with two membranes called *Dura* and *pia Mater*: of which we haue spoken in the 7 chap. of the 7 booke, and thither referre the Reader for satisfaction, only heere we remember that they compasse not the Braine only, but his Vicar and substitute the spinall marow, yea all the nerues throughout their generations.

The Middle Region is inuested round with a membrane which is stretched vpon the ribs, excepting the twelfth, and is called *Pleura*: of it we haue spoken in the 6 chap. of the 6 booke, as also of the purse of the heart and the *Mediastinum* which arise therfrom, in the seuenth and eight chapters.

In the Lower Belly, the *Peritonaeum* comprehendeth or embraceth all the contained parts, and of it we haue spoken at large in the 10 chap. of the second booke.

Of the parti-
cular parts.

The particular partes of the body are almost euery one couered with their peculiar membranes or coats. The eyes haue fixe, called *Coniunctina*, *Cornea*, *Vnea*, *Aranea*, *Ciliaris* and *Reticularis*, of which we haue spoken in the sixt, seuenth, and eight chapters of the 8 Booke. The tongue is inuested and iudgeth of Sapers by a proper coate arising from the third and fourth coniugations of sinewes. The Gullet, the Mouth, and Palat and the Chops are couered with the same coate that couereth the Stomacke; the Heart it selfe, the Lungs, the Liuer, the Guts, the womb, the bladder and all the vessels haue their particular coats: so haue also the Kidnies and that thicke, which they call *Fasciam* or the swath-band. The Kell is made of the *Peritonaeum* duplicated, so is also the Mesentery. A world of other Membranes there are, which we haue remembred in their particular places, and therefore list not now to trouble either our selues or the Reader with them, seeing they may easily be found by the title of the Chapter in those places to which they belong; we proceed vnto the Fibres, wherein also we will be very short, for we hasten to an end,

CHAP.

The fourth part, of the Fibres or Villi.

CHAP. XIII.

The nature of Fibres.



Fibres are called in Greeke *ῥῆς*, in Latine *Villi*, although that name is sometimes communicated both to Nerves and to Tendons: some call them *κνησίδες*, because they are like the strings or lines in plants, or graines in the wood. *Laurentius* defineth them to bee *Similar parts, cold and dry, ingendred of the Seed, and therefore white, solid and long, like fine spun threads, destinated or appointed for motion, and to hold the flesh of the parts, wherein they are, together.*

The definition
of a Fibre.

The first particles of the definition are so manifest as they need no explication, the latter which designe their use or finall cause wee will open in a few words.

There are two especiall uses of Fibres, Motion, and Preseruatiō of flesh. Motion according to the Physitians, is three-fold, animall, vitall, and naturall.

Their 2 uses.
Motion three-
fold.

Animall or voluntary motion is performed by the helpe of the muscles: a muscle is moved when his fibres are either intended or drawne toward their originall, and therefore, saith *Galen* in the 8 de *Anatom. administrat.* if you cut all the fibres ouerthwart, the muscles will presently loose all their motion.

The vitall motion belongeth to the heart, and to the Arteries, for the heart hath his fibres manifold and very strong, by whose helpe it is distended, contracted, and quieteth himselfe. The arteries also haue their fibres, in their inner coat many transuerse, in the vter coate oblique and right.

That motion we called Naturall, is most manifest in Attraction, Retention and Expulsion. Wherefore all manner of motions proceed from fibres, but their common Action is Contraction.

Notwithstanding, we must know that these naturall Organs had not their fibres allowed them for a peculiar Traction, Retention and Expulsion, but for a common and officiall. So the Stomacke, the Guts, the Veines, the Arteries, the Wombe, the Bladder, the Heart, and such like, did not stand in need of fibres for their priuate nourishment (for the Bones and the Braine, and the Gristles, and the Flesh of the Bowels doe draw their proper Aliment without fibres) but for a common and officiall action. The Heart for the generation of vitall spirits; the Arteries for the commoderation or tempering of the natieue heat; the Veines for the transmission or transportation of Blood; the Stomacke for the making of the *Chylus*; the Guts for the distribution of the same *Chylus*, and the excretion or euacuation of excrements; the Bladder for miction or making of water; the Wombe for Conception, and for the Birth.

Fibres necessary
for officiall
actions.

The other use of the Fibres is the custody or preseruatiō of the Flesh, as well musculous, as that which maketh the proper substance of the part, for the fibres are, as it were, the first *stamina*, or the warpe, whose empty distances, the flesh like the woofe filleth vp. There are also other peculiar uses of Fibres in the Veines and Arteries, to wit, that thereby they might be better extended after all the violent motions of the Blood, and so become lesse subiect to mischiefe.

The second
use.

CHAP. XV.

Of the differences of Fibres.



The differences of Fibres are to be taken from their site, hardnesse, sense, texture, and from the variety of the Organs. From the site they are called Right, Transuerse and Oblique, for if they run lengthwise, then they are called Right fibres. If they run according to the breadth and intersect, or cut the right, then are they called Transuerse or round and circular fibres. If they haue a middle situation and intersect both the right and the transuerse at vnequall angles, then are they called Oblique fibres. The office of the right fibres is to draw, the office of

The difference
of Fibres.

How Retenti-
on is made.

the transuerse to expell, and that of the oblique to retaine. If the right fibres worke alone then the length of the part is shortned, and attraction made; if onely the transuerse be contracted, then the latitude or breadth is diminished, and expulsion made; but if all the fibres together, the right, the oblique, and the transuerse be intended, then the whole part is contracted and retention made, which also they call *Amplexation*. Retention therefore is made not when any one kinde of fibre doth worke, but when all are in action together; for so when we would firmly retaine any thing in our hands we compasse it about on euery side: yet the oblique fibres are said peculiarly to retaine, because when they are contracted, they doe not onely imbrace, for they compasse the part on euery side, constringing and closing together the particles thereof: but the right and the transuerse fibres when they are contracted, doe not onely serue for retention, but these for expulsion, and those for traction.

The second
difference.

The second difference of fibres may be taken from the hardnesse, for some are hard and strong as those of the heart; for the feruent force of the inbred heat did require so much, as also the perpetuall agitation of his necessary motion, others are softer as the fibres of muscles.

The third

The third difference is taken from their sense. Of fibres some are sensible as those which arise from Nerves: Others insensible, as those that proceed from the ligaments of bones. If you regard the texture of fibres, some are so permixed, that they make a continuall body, so true membranes haue their fibres, yea, they are nothing else but fibres conioyned one within another. Others are separated from the substance of the part and haue another vse beside the vse of the part, and these are either simple, as in the muscles (for all the muscles excepting a very few, haue but one kinde of fibres, either right or transuerse, or oblique) or manifold, and so wouen together, that no Art is able to make separation betweene them.

The fourth.

How the fi-
bres are pla-
ced in the
Naturall or-
gans.

So the flesh of the heart is wouen with all three kindes of fibres, and in the naturall organs which serue for naturall motion, if the part haue one proper coat, as a veine, the wombe, the two bladders, then in that coat are all the fibres placed; but if it haue two coats, one externall, the other internall, then are the transuerse fibres placed in the externall coat, and the right and the oblique in the internall. From this generall rule you must except the guts and the arteries, because the guts doe serue for distribution and excretion, and the arteries for the expurgation of the heart. Now Nature is more carefull for the expulsion of that which is hurtfull, then for the traction of that which is profitable.

The last dif-
ference.

The last difference of fibres is taken from the variety of organs, some serue the animal Organs, as the Muscles, the Nerves, the Ligaments, and the Tendons: others serue the Vitall, as the Heart and the Arteries: others the Naturall, as the Gullet, the Stomacke, the Guts, the Bladders, the Wombe, and the Veines. But what euery one of these fibres in their severall courses doe performe, and how they are disposed in the parts, wee haue declared before in the particular History of euery part.

And thus much concerning the fibres: Now we proceed vnto our last taske of the
Bones.

The end of the twelfth Booke.



THE THIRTEENTH BOOKE,
Of the Bones.

The Præface.



Ship that hath been long at sea, discovered many strange Continents and rivers, struggled through many hiddeous tempests, escaped many rocks and quicke-sands; though she hath made no rich returne, yet when she commeth within ken of her owne Countrey, and sees the land lye faire before her: If thou canst imagine (gentle Reader) how sodainly she forgetteth her irksome trauell, thinke also how well apaid I am, that I am come within view of the end of this my tedious Voyage. For I also have trauelled about a *world*, and that for thy behoofe.

In my iourney, if I haue not made many new Discoueries; yet certainly I haue sounded the depths more truly, entered farther into the Continents, coasted the Shores, plyed vp the Frythes, discovered the Inhabitants, their qualities, tempers, regiment of life, their dyet, their apparell, their employments: and in a word, I haue made it easie for thee to reape the profit of many mens Labours, and of mine Owne. Yet thou must vnderstand this but as a Letter of aduertisement from the Coast. I haue not yet brought my Barke about: Many haue shunned *Scylla* and *Charybdis*, and haue miscaried euen in the mouth of the Hauen, where there are more Rockes then in the Maine; Many Reaches, which wee must haue diuers winds to fetch, and therefore thou must haue patience, if wee make not so fresh a Way, but be constrained to winde in by Bourds; and in the meane time, forget not thou to follow vs with thy vowes. For this Shore is buttrest with Rockes on euery hand, the Currants swift, the shallowes many. To breake off our *Metaphor*: The History of the Bones is a busie piece of Worke; their Articulations and Compositions many dissolute and lax, many strict and close; Their Coalitions hard to be discerned, harder to be expressed; Their Perforations, Cavities, Bosomes, Appendancies, Prominences and Proccesses, difficult to distinguish. Now therefore, if at any time, I stand in need of thy patience; (gentle Reader) for my Stile here must be abrupt and broken, hard and harsh of necessity, according to my Argument. If thou canst finde Profit, looke not for Pleasure; and if thou finde it hard to reape in this vnequall Field, remember hee had something to doe that brake vp the Swarth, and sowed it for thee.

C A H P. I.

Of the definition and differences of Bones.



He Bones, saith *Hippocrates*, τὸ σῶμα ἐστὶν ὡς ὁρθότατα καὶ εἰς τὸ παρεχόμενον, that is, doe giue to the whole body stability, rectitude, and forme: for they are, as it were, the carcasse of a ship, whereto the rest of the parts are fastned, whereupon they are sustained, and the whole mounenance of the body is built and consummated. From their figure and magnitude, we esteeme of the figure and magnitude of the rest of the parts: without the knowledge of the Bones we must needs be ignorant of the originals and insertions of muscles, of the courses of the Veines, of the distribution of the Arteries, and of the partitions of the Nerues. The vniuersall *Syntax* or composition of the Bones, from the Head to the Feet, the ancient *Gracians* called σκελετὸν ἀπὸ τῆς σκελεῖν, as it were a dried or arrid carcasse.

The know-
ledge of the
bones necessa-
ry.

Galen's defi-
nition.

Laurentius de-
finition.

The explicati-
ons thereof.

The forme.

The matter.

The efficient.

The end.

Stability.

Rectitude.

Galen defineth the bones to be the hardest, the dryest, and most terrestriall part of the creature. But this definition doth not please the pallats of the new Writers, as being not exquisite or Philosophicall, but made onely for the ruder, and more ignorant sort to innitiate them.

Laurentius defineth them more accurately thus.

A Bone is a similar part, the dryest and coldest of all the rest, made of the earthy crassament and fatnesse of the seed by the formative faculty, assisted by the strength of heat, for the stability, rectitude and figure of the whole body.

And this definition he saith is Essentiall, because it designeth all the causes of Bones, the Efficient, the Materiall, the Formall and the Finall. The forme of similar parts, according to the Physitians, is the Temper, because it is the first Power, whereby and wherewith the forme worketh and suffereth whatsoener the similar part worketh as a similar. Siccity therefore and Frigidity, dryth and coldnesse doe expresse the forme of a Bone. It is dry, because of the exhaustion of moysture and farnesse, made by an intense or high heate. Cold it is, because the heate vanisheth away for defect of moysture. These primary qualities are accompanied with secondary, hardnesse, heauinesse and whitenesse. A Bone is hard not by concretion as yce, for then it would be dissolued by the fire, not by tention as the head of a drumme, but by siccity, as wood.

Heavy it is, because it is earthy, as also because the ayre and the water in it are extreamly densated and thickned: and it is white, because it is spermaticall.

The matter of the Bones is the crassament of the seed, that is, the thicker and more earthy part. *Aristotle* calls it *Seminale excrementum*, the excrement of the seed. For though the seed seeme to be *Homogeny*, yet it hath some parts thicker then others.

There is in it also something fat and something glutinous or slimy. Of the glutinous part, because it may best be extended or stretched, are made the nerues, membranes and the ligaments. Of the fatty part are made the Bones, and this *Hippocrates* confirmeth, when he saith, *where there is more fat then glew or slime, there the Bones are formed.*

The Efficient cause of a Bone is the formative power which some call the Idoll or the Idea of him that ingendreth: this faculty vseth the heat for his Architect, and the spirit for his chiefe workeman, and to these the Philosopher attributeth Ordination, Secretion, Concretion, Densation and Rarification. The heat therefore drinketh vp and dryeth the fatnesse, whence comes hardnesse and solidity. So saith *Hippocrates*, *Bones are condensated by heat, and so grow hard and dry.*

Furthermore this heat, although it be moderate (for the substance of our native heat is well tempred) yet because it maketh a longer stay in a more dense and fast matter, it bringeth forth the same effects that an intense or high heat doth: yea it seemeth to burne, whereupon *Hippocrates* doubted not to say, *that the generation of Bones was made by exsuffion, that is, by burning.*

The finall cause of Bones which *Galen* is wont to call their vse, is well expressed in the last particle of the definition. For the primary and most common vse of Bones is to giue the body stability, rectitude, and figure. Stability, because they are as it were propugnacles or defences against all violence, beside they sustaine the body as the bases or finials of a house sustaine the rooffe. Rectitude, because without bones the creature cannot stand vp-right, but would creepe vpon the ground, as a Serpent or a Worme. *Hippocrates secundo Epide-*

Epidemion, maketh mention of a childe borne without bones, yet were the principall parts of his Body separated and fashioned, but he was not aboue foure fingers long, and dyed soone after he was borne.

Finally, the bones do giue the figure to the body, because from them dependeth the procerity or stature and the limitation of the groweth. For those that haue a great head haue large braines, those that are narrow chested, their Lungs also and bowels are but short and narrow: those that haue small iawes haue also small muscles. By reason of this finall cause (which being it selfe immouable, moueth all the rest) the bones are of that substance which we see, hard, solid, and insensible: hard and solid for so it behooued a pillar or proptor be; insensible *ad sensum*, that they should not be so apprehensie of paine, for because they sustain the burthen of the body and are continually moued, they could not haue endured so diuers motions without paine if they had bene sensible thereof, and then the life of the creature should haue bene alwaies sad and querulous. But this want of sense comes not from their earthly substance; for then the teeth which are the hardest of all bones should haue no sense; but because there are no nerues diffeminated through their substance.

Why bones are insensible.

The differences of Bones are to be taken saith *Galen*, as also the differences of singular parts from those things which follow the essence or happen thereto.

The differences of bones.

The essence of a bone, that is, his cold and dry temper doe the Tactile qualities follow, Hardnesse, Softnesse, Density, and Rarity; the accidents are Magnitude, Figure, Situation, Motion, Sense, and the like.

The first diuision therefore of bones is, from their hardnesse. Some bones are very hard as those that are called Stony bones and the Teeth; others soft in respect, as the spongy bones and those which we call *Appendices* or *Appendants*; others are simply hard as all the rest.

From the hardnesse.

From the magnitude some bones are great, some little, and some moderate. There are among the Anatomists that account those bones to be great which are of a large bore or very hollow and medullous or marrowy. But we make account of such bones for great as are great in quantity, whether their marrow be lesse or more, for the hanch-bones and the shoulder-blades which are not hollow nor medullous are yet great bones, But because the quantity belongeth to Dimentions and Dimention is three-fold, long, broad, and deepe, therefore from the magnitude of bones may be taken a three-fold diuision of them. For some are long as the thigh bone, others are short as the bones of the fingers: some are broad as the shoulder-blade and hanch-bones: others narrow, some crasse or thicke, others fine or thinne.

Magnitude.

From the figure some bones are plaine, some round, some haue three sides, some haue foure, some are like a boar, some like a Cube or Dye, some like a Mallet, or an anuill, or a stirrop, &c.

Figure.

To the figure also we referre (as the best Physitians doe) the passages and cauities, the smoothnesse or roughnesse. Some therefore are solid, others not solid: some smooth and some rough; I call that solid which is not hollow, Solid bones therefore doe either appeare altogether solid hauing no cauities or dens in them, or at least none sensible, as the bones of the eares and the nose; or else they appeare solid on the outside, but within are full of perforations and holes like sponges, as are the bodies of the rackbones. To solid bones wee oppose those that are hollow, that is, such as haue a sensible or conspicuous canity, which *Galen* calleth *κοιλια*, a belly.

In these is that substance contained which we properly call marrow, in latine *Medulla*, and therefore such bones we say are medullous, that is, marrowy bones.

From the situation there may a twofold difference of bones be taken, because vnder the name of situation we comprehend the position and the connexion.

If you respect their position, some are vpper, others are lower, some on the fore-side, others on their hindside, &c.

If their connexion with other parts, some are fastened by muscles, some by ligaments, and some by gristles. From motion, some bones are moued, as those that are articulated by *Diarthrosis*; some are immouable, as those that are fastened by *Synarthrosis*.

Motion.

From Sense, some bones are sensible as the Teeth, all the rest without senses.

Sense.

Finally, we will adde the difference of bones which is taken from the order of generation. For some bones are generated perfect and compleate, as the small bones of the eares

eares

eaues, the ribs, and the cannell or coller bones. The bones of the eaues, because it was fit they should be very hard and very dry the better to resound. The ribs because they were to make the cavity of the chest wherein the heart was to moue from the very birth. The coller bones because they tye the armes to the body and strengthen the brest. Other bones are at the first imperfect a little differing from Gristles, as the bones of the Head and many in the body beside.

And thus much of the differences of bones; now we proceede vnto their parts.

CHAP. II.

The particular parts of bones and an exposition of many appellations or names, of which we shall haue frequent vse in the History of the Bones.

Three parts of a bone.



N Bones two things are to be considered; their parts and their cavities. The parts of a bone are three-fold; the principall part whereof the bone consisteth; the part that groweth to the bone, and the bunching part of the bone. The principall part of the bone hath no proper name belonging thereto, but is called by the name of the whole bone. The part that groweth to the bone is properly called *Epiphysis*. That part which buncheth or beareth out beyond the plaine surface is called *Apophysis*. The principall part is the primary bone made by Nature, as a man should say, at the first hand or according to Natures first intention. This is the basis of the rest and occupieth the middle place as being the hardest part; for it is in the generation of bones as in the structure of the Vniuerse, that which is hard and earthy is placed in the Center.

The principall.

The Appendix.

To this principall part oftentimes groweth another which the *Gracians* call *ἐπιφύσις*, the *Latines* Appendix, we may call it an Additament, or if you will we may retaine the Latine word Appendix, because it is growne in vse amongst vs. For as if Nature had forgotten her selfe & made the bone too short, she eeketh it out by this Appendix as worke-men vse to lay stones or timber vnder their postes or pillars to lengthen them when they are too short. This appendix *Hippocrates* often calleth *μεγμν*, which we note but by the way.

An appendix therefore is a bone by it selfe, fastened to the whole bone by *Symphysis* or *Coalition*; not the vnition it selfe of one bone with another, for so there should be no difference betwixt *Symphysis* and *Epiphysis*, *Coalition* and the *Appendix*. That it is a bone by it selfe is manifest because it hath a proper and peculiar circumscription, and in yong creatures may easily be separated without coction or putrification; yet it hath often been obserued that in young children it hath been luxed, if I may so say, by a blow or by a fall and separated from his bone. This Appendix is fastened to the principall bone by that kinde of *Symphysis* or *Coalition* which is made without a *Meane*, because the extremities or ends of the primary bone are softer then their middle part. Now the substance of an Appendix is rare and lax, but saith *Aristotle*, *Soft things are easily contained in the termination of another, and yeeld vnto them*. This *Coalition* is not made by a plaine superficies or surface but by a mutuall ingresse of a head and a Sinus or bosome, which kind of coniunction doth much resemble that which afterward we shall call *Ginglymos*.

Their Coalition.

Their substance.

The substance of an Appendix is rare and lax, at first gristly, but in proceffe of time it groweth harder and drier because in the motion of the ioynts and their attrition the heat is stirred vp which drieth and hardneth it. To the extremity of the Appendix Nature hath added a gristle that they might not be so subiect to outward iniuries, or if they happen to be broken yet the softnesse of the gristle may helpe them to reuinite againe. In old bodies they are so vnited with the principall part of the bone that they can very hardly be separated, yea they seeme to be very parts of their bones. All bones haue not this Appendix, for in the lower iaw there is none. In some bones there is but one, as in the rootes of the ribs and in childrens teeth: in others it is double one at either end, as in the Legge, the Brace, the arme, the Ell and the Wand. In others it is treble, as in the haunch-bone; some haue foure as the bone of the thigh, three in the vpper part and one in the lower. The *vertebra* or rack bones haue fise, two in the transuerse processe, two in the bodies, and one in the Spine. There are many Appendices which are ordinarily by the people taken for processe, as the tooth of the second Rack-bone, the great Trochanter, Stryloides, &c.

The

The vſes of theſe *Appendices* or Appendances are diuers, *Galen* acknowledgeth a double vſe : one that in Bones which haue marrow they ſhould ſerue in ſteade of a couer to keepe the marrow in, for that which is hollow and ſolid as is the lower iaw, doth keepe in his marrow without an Appendix.

The other vſe is for more firme articulation, for a bone is better eſtabliſhed vpon a large *Baſis* whereas if the bones ſhould determine into a ſharper poynt, their conſtruction or articulation would be more dangerous & deceitful, & the bones eaſily and vpon a light offence would fall out of their ſeates. And herein Art imitateth Nature, for the *Baſis* or foote of a *Finiall* or *columnne* for more ſecurity is made large and broad. But becauſe theſe Appendances are broad, Nature made them rare and lax, leaſt their waight ſhould preſſe too much vpon the parts vnder them.

To theſe vſes of *Galen* we may alſo adde others, firſt that out of them the *Ligaments* might take their originall, which either faſten the bones or make the tendons or chords of muſcles. *Falopius* obſerued that the *Ligaments* were not extended or lengthned beyond the *appendices*, as if the appendix be ſhort the *Ligament* is alſo ſhort.

Moreouer, the Appendix being ſofter then the bone and harder then the *Ligament*, interpoſeth it ſelfe as a mediator betwixt the coniunction of the bones; for ſuch is Natures vſe to couple things that are extreame by thoſe that are in a meane.

Adde hereto, that by the interpoſition of the *Appendices* the fracture of a bone, if it happen, is ſtayed and goeth no further, as appeareth in the ſutures of the head.

Againe, *Appendices* were made for the conſeruation of the ioynt. For a bone being very hard, if one hard thing ſhould haue bene committed or conioyned to another, by reaſon of their continuall motion they would haue bene broken or at leaſt worne as the teeth are, and therefore the bones were conſtrued or conioyned by ſofter bodies.

Some out of *Hippocrates* doe imagine that the Appendix was made to be as it were the belly of the bone wherein his Aliment is concocted, from whence by degrees it is percolated or ſtrayned into his ſpongy or hollow parts. And thus much of the ſecond part of a bone.

The third part of a bone the Grecians call ἀπόφυον, the Latines *Proceſſum*, many other appellations it hath in Greeke and Latine, but we take the moſt common. In Engliſh we call it a *Protuberation* or *Proceſſe*, and may be deſcribed thus : A proceſſe is a legitimate part of the bone, breaking out of the bones it ſelfe, and bunching beyond his plaine and euen ſurface : ſuch as are the knags of Harts-hornes. Euery bone almoſt hath his proceſſes, but they are moſt conſpicuous in the lower iaw and in the racke-bones.

Their vſe we acknowledge to be double : one for the originals and implantations of many parts, eſpecially of muſcles; for vſeſſe the bones had protuberations or productions in them, neither muſcles nor ligaments could grow from them. Another vſe of theſe proceſſes is, that in ſome parts they ſhould ſupply the place of a defence as it is in the racke bones and in the ſhoulder-blades.

The differences of *Appendices* and *Proceſſes* are taken from their Figure. For if the protuberation be round it is called a *Head*, whether it be an appendix or a proceſſe, If from a narrow beinning it be by degrees dilated, it is called a *Necke*. If it end in a coner or an acute termination it is called *κονοειδης*. An Appendix therefore or a Proceſſe is three-fold according to the variety of their figure, a *Head*, a *Necke* and a *Point*.

The *Head* is double, one which is abſolutely called a *Head*, long and large, ſuch as is the head of the Thigh-bone: the other depreſſed which is commonly called *κόνδυλος*, we may properly Engliſh it a *Knuckle*.

The *Necke* is only of one ſort, herein differing from the head, that for the moſt part the head is an appendix and the necke a proceſſe.

That which is called *κονοειδης*, the *Cone* or *Poynt*, an acute or ſharpe proceſſe, is manifold. One is like a *Bodkin*, another like an *Anchor*, another like a *Crowes beake*, and another like the nipple of the *Dugges*.

The firſt is called *Styloides* or *Graphoeides*; the ſecond *Anchyroides*, the third *Coracoeides*; and the fourth *Mastoides*.

Thoſe proceſſes which at the circumference of the cauities doe hang out like lippes and increaſe the depth of the *Cup* are called *Browes* or *Lips* or *Verges* or *Brimmes* or what you liſt, for all theſe things they doe reſemble. And theſe are the parts of a bone in general.

A proceſſe.

Their vſes.

How they differ from appendices.

The head.

The necke.

The poynt.

The

Differences
of cavities.

The second thing to be considered in a Bone was cavity, which was made for the articulation or construction thereof. Of cavities there are two sortes; some are deepe and some are shallow. The deepe cavities which haue high and large browes about them are called *κοτύλη*, a *Cup*, and indeed it is most like the new fashioned siluer bowles which are round and deepe, and the edges hanging ouer their cavities: such are found in the hanch-bone and in the shoulder-blade. The superficially or shallow cavities are called *γλινδα*, from the cavity of the eye when the liddes are shut: and they are so obscure that at the first sight you may doubt whether they admit another bone or themselves enter into another: These cavities whether they be deepe or shallow, *Hippocrates* calleth *βαθυιδες*. And these are the Appellations and names which we thought good in this place particularly to explaine, because in the History of the Bones you shall meete with very frequent mention of them. Now we proceede vnto the structure and connexion of bones.

CHAP. III.

Of the structure and connexion of Bones in Generall.

Why mans
body was not
made of one
bone.



An being created for Vnderstanding and Action, to receiue infinite images of Sensible things, & to flye or apply himselfe to the diuers objects of his appetite, stood in need of locall motion, but if he had been made of one continuall bone, how could he haue bent or extended or compassed his body; how could he haue apprehended any thing or moued himselfe forward to attaine it? No; he must haue stood like a trunke or a blocke, and the creature that was made to command all the rest would haue beene a right Mauchen or gazing stocke to the rest. Nature therefore for the better accomplishment of the varieties of motions, hath wonderfully framed the body of man of a Packe or Set of bones, of diuers kinds and manifold figures. And this diuersity is also of as great consequence *ad vtilitatem*, that when one bone is broken the fracture might stop and not offend the rest. Hereby also is there fit way made for Transpiration of fumid vapors: hereby are the parts discriminated or distinguished one from another: hereby is the ingresse & egress made for the vessels. Notwithstanding though this connexion be diuers, yet is it so strangely fitted together that al seeme to be but one: one I say either by Continuity or by Contiguity at least. The vniuersall compage or coagmentation of the bones is called a *Syntax*, and the packe of bones so fitted together is called a *Skeleton*.

What a Skeleton
is.

The manner of this *Syntax* or cōposition is double, for it is made either by *Articulation* or by *Coalition*. *Articulation* we define to be a naturall structure of the bones, wherein the extremities or ends of two bones do touch one another. So that the whole Nature of *Articulation* consisteth in the Contaction of extremities or ends. This Articulation according to *Galen* is double; one laxe and loose called *Diarthrosis*, for *δια*, in composition of words signifieth a separation or loosenesse; another strict and so compacted that there is no space left for any motion. And this kinde is called *Synarthrosis*. The first is with manifest motion; the second hath no motion at all, or if it haue any it is scarcely conspicuous.

Diarthrosis.
Enarthrosis.
Arthrodia.

Of *Diarthrosis* there are three kinds, *Enarthrosis*, *Arthrodia* and *Ginglymos*; *Enarthrosis* is when the cavity that receiueh is deepe, and the head inserted into it long, and such is the articulation of the Thigh-bone with the Hanch. *Arthrodia* is when the cavity is superficially or shallow, and the head depressed or almost plaine; and such is the articulation of the lower iaw with the Temple-bone and the Nowle-bone with the first spondell. *Ginglymos* is when the same bone receiueh and is receiued, as it is in the hingedes of a doore, wherein the yron that carrieth the hinged and the hinged that is carried doe mutually enter one into another.

Ginglymos.

In *Ginglymos* therefore the gibbous part of one bone entereh into the hollownesse of another; and againe the *Sinus* or bosome of one bone admitteth the gibbous or embowed part of another.

This *Ginglymos* is made two wayes; for either the same bone is receiued by one and receiueh it againe, or it receiueh one bone and is receiued of another.

An example of the first we haue betwixt the Arme and the Cubit: of the second in the Racke-bones of the Backe, for the *vertebra* in the middest receiueh that spondell which is aboue it, and is receiued by that which is vnder it.

Of

Of *Synarthrosis*, there are also three kinds, *Rhaphe*, *Harmonia*, and *Gomphysis*. *Rhaphe* the Latines call *Sutura*, a seame, for it is like the seame of a garment: and it is a double, one toothed like a Saw or a Combe, the other plaine, like the Scales of a Fish, or the Mayles of a Harneffe, or Nailes of the fingers, one thrust vnder another. The first we finde in the sutures of the Scull, the second in the Temple-bones. *Harmonia* is an articulation by a simple line, either right, oblique or circular, and so are almost all the bones of the vpper Iaw ioyned together. *Gomphysis*, is when one bone is fastened into another, as a naile into a boord, and so the teeth are set in the Iawes. And these are the two kinds of articulation, *Diarthrosis* and *Synarthrosis*, vnto which we may adde out of *Galens* twelfth chapter of his booke *De ossibus*, a third which is a neutrall articulation, halting betwixt two, and participating of them both, yet being neither perfectly: and this neutrall articulation, because the motion thereof is obscure, may be said to belong to *Synarthrosis*, but in respect of the manner of his composition which is made by a cavity and a head, it may be called *Diarthrosis*. Such is the articulation of the ribbes, with the breast-bone and the rackes: such also is seene in the wrist and the instep. And these are the differences and kinds of articulation.

The neutrall articulation.

The other kinde of composition is called *Symphysis* or *Coalition*. For Nature well foreseeing that the articulation of great bones was not very secure, because they might easily slip out of their seats, she therefore deuised a more streight or neere kinde of coniunction or colligation, which Anatomists doe call *Symphysis*, wee coalition, which is nothing else but a naturall vnion of bones, by which two bones are continued together and made one, so that the nature of coalition consisteth in continuity, as the nature of articulation did in contiguity or contaction of extremities.

Coalitions

This *Symphysis* or coalition is double, one with a mean, another without a meane. Those bones that are soft and fungous, doe grow together without a *Meane*, so all appendancies almost, because they are soft and gristly, are vnited with bones by coalition, but those that are dry and hard, cannot be vnited without the inter-vening of another body. That middle body is three-fold, a nerue, a gristle and flesh. And hence proceed the three differences of *Coalition*, *Synchondrosis*, *Synneurosis* and *Synsarcosis*. An example of *Synchondrosis* we haue in the share-bones, and in the lower Iaw. An example of *Synneurosis* in euery *Diarthrosis*, but you must vnderstand that by a nerue in this place, we meane a ligament. An example of *Synsarcosis* you haue in the bone *Hyois*, and in the shoulder-blades, but by flesh here, we vnderstand muscles. We haue here added a Table which containeth their pedigree,

whereto we will not so exactly stand, as that there may be no exception taken

thereto by curious Schollers, either in the manner of diuision, or in the

appellations, although I presume such as will be most ready to

finde fault, will not finde it so easie

to amend.

The

The Table of Connexions.

| | | |
|--|---|--|
| | <i>Inarticulation</i> , when the Cup is deepe, and the Head long, and it is called <i>Enarthrosis</i> , as betwixt the Thigh and the Hip. | When the same bone is received by one bone, and againe receiue the same, as betwixt the arme and the cubit. |
| | <i>Adarticulation</i> , when the cup is shallow, and the head oppressed, and it is called <i>Arthrodia</i> , as betwixt the lower iaw and the temple-bones, the Nowle and the first Rack-bone. | |
| | <i>Hinge-bung</i> , when the same bone receiue the same bone, and is received, it is called <i>Ginglymos</i> , and it is made two wayes. | When it receiue one bone, and is received of another, as a middle racke-bone, receiue the vpper and is received of the lower. |
| | <i>Seame called sutura</i> , and it is double. | <i>Toothed</i> like a Saw or a Combe, as the futures of a Scull. |
| | <i>Coarticulation</i> , which is a strict and well compounded iuncture, and it is called <i>Synarthrosis</i> , it is also of three sorts, by | <i>Plaine</i> , like the Scales of a Fish, as the temple-bones with the scull. |
| Bones are ioyned or compounded by | <i>Articulation</i> , whose nature consisteth in contiguity of extremitie, & it is threefold. | So almost are all the bones of the vpper Iaw articulated. |
| | <i>Mortize</i> , which is when one enters into another, as a Tenant into a Mortize, so the teeth are fastned in the Iawes, and this is called <i>Gomphysis</i> . | <i>Right</i> .
<i>Oblique</i> .
<i>Circular</i> . |
| | <i>Galen</i> addes a third, which is neutrall or doubtfull; and is neither the one nor the other, but partaketh of them both, agreeing to <i>Coarticulation</i> , by reason of the obscurity of the motion, and to <i>Dearticulation</i> , if you regard the composition of the heads, and the cavities. Such is the articulation of the ribbes, with the breast bone and the racke-bones, and that of the bones of the wrist and instep. | A Gristle, such <i>Coalition</i> is called <i>Synchondrosis</i> , and it is found betwixt the share-bones.
A Ligament called <i>Symenrosis</i> , and is found in all <i>Dearticulations</i> .
Flesh called <i>Synsarcosis</i> , and is found in the bone <i>Hyois</i> , and the shoulder-blades. |
| <i>Coalition</i> or vnion, whose nature consisteth in continuity, and it is called <i>Symphyis</i> . It is double: | Without a <i>Medium</i> or <i>Meane</i> , so doe soft and fungous bodies grow together, as almost all Appendancies. | |
| | With a <i>Meane</i> , as dry and hard bones which are not vnited without the interposition of some middle body: & that is, | |

when the same bone
is joined by one bone,
and receive the
as betwixt the
and the cubit.

when it receive
one, and is received
her, as a middle
bone, receive
upper and is recei-
the lower.

like a Saw or a
as the fumes of

the Scales of
as the temple
in the skull.
So almost all
the bones
of the upper
jaw articu-
lated.

into another, as
they are joined in
fist.

neither the one
relation, by re-
ard the compo-
ne ribbes, with
the wrist and

ion is cold Syn-
ound betwene

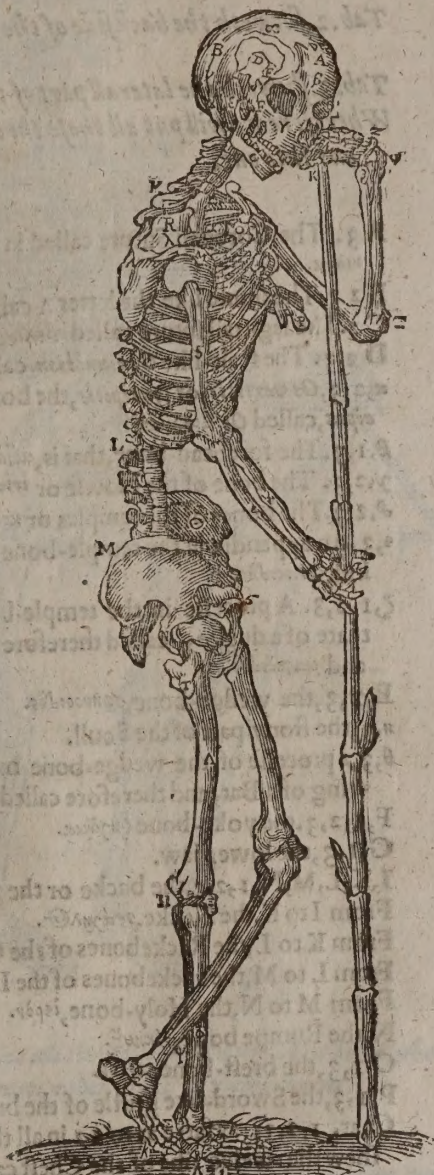
menorfu; and
ulations.
and is found
the shoulder.

To this place also we have thought good to adde six severall Tables containing the Sceleton or packe of Bones throughout the whole body, as they appeare before, behind, and on the side in a man; the Sceleton of a woman; of an Infant new borne, and of two vntimely Births, with their descriptions at large, by which the Reader may be well initiated before he cometo the particular History.

TABVLA I.



TABVLA III.



TABVLA II.



Tab. 1. sheweth the forepart of the Sceleton of a man, that is to say, the whole packe of the Bones and Gristles in a mans body, as they appeare on the fore side.

Tab. 2. sheweth the back side of the Sceleton.

Tab. 3. sheweth the laterall part of the sceleton. Wherefore we will put all these three descriptions into one.

A 3. The Coronall Suture called in Greeke *σφηνοειδής*.

B 2 3. The suture like the letter Δ called *λαμινειδής*.

C 2. The sagittall suture called *ὀβελιαία*.

D 2 3. The scale-like Coniunction cald *λεπιδειδής*.

a, 2, 3. Os verticis, or *synipitis*, the bone of the Syniput, called Os *βρεγματική*.

β, 1, 3. The forehead-bone, that is, *μετωπιαία*.

γ, 2, 3. The bone of the Nowle or *νύς*.

δ, 2, 3. The bones of the temples or *κεφαλαίαι*.

ε, 3. An appendix in the temple-bone like a Bodkin, *στροφαίτης*.

ζ, 1, 2, 3. A proceffe in the temple-bone like the teate of a dugge, called therefore *Mamillaris* and *μαστοειδής*.

η, 2, 3. the wedge-bone, *σφηνειδής*.

θ, 3. the stony part of the Scull.

θ, 3. a proceffe of the wedge-bone much like the wing of a Bar, and therefore called *πτερυγοειδής*.

ι, 1, 2, 3. the yoke-bone *ζυγία*.

κ, 1, 3. the lower iaw.

λ, K, L, M, N, 1, 2, 3. the backe or the spine, *σπονδυλική*.

From I to K, the Necke, *αχλαίτη*.

From K to L, the Rackebones of the Chest.

From L to M, the rackebones of the Loynes.

From M to N, the Holy-bone, *ιερόν*.

N, the Rump-bone, *ὀσφυς*.

O, 1, 3. the brest-bone, *στέρνον*.

P, 1, 3. the Sword-like gristle of the brest, *ξίφοειδής*.

Char. 1, 2, 3. as farre as to 12 in all three Tables, shew the twelve ribs of the Chest cald *πλευράι*.

Q, 1, the clauicles or collar bones, *κλείδες*.

R, 1, 2, 3. the shoulder-blade, *ωμοπλάτης*.

λ, 1, 2, 3. the vpper proceffe of the shoulder-blade, or the top of the shoulder, called *ἀκρώμιον*.

μ, 1, 3. The lower proceffe of the shoulder-blade, called *ἀγχιρροειδής*.

S, 1, 2. the bone of the arme, called *Humerus* and *βραχίον*.

T, V, 1, 2, 3. the Cubit *πῦξ*.

X, 1, 2, 3. the wand or the vpper bone of the Cubit, called *καρπία*.

Y, 1, 2, 3. the ell or the lower bone of the Cubit, called *πῦξ*.

z, 3. the proceffe of the Cubit, *ὠλέκρνον*.

ξ, 1, 3. the proceffe like a bodkin or probe, called *στροφαίτης*.

ZZ, 1, 2, 3. the wrest *καρπός*.

Π, 1, 3. the after-wrest *κεφαλαιόπυον*.

ΔΔΔ, 1, the fingers *δακτύλοι*.

Θ, 1, 2, 3. the bones ioyned to the sides of the Holy bone, on each side one, distinguished as it were into three parts.

ο, 1, 2, 3. the first part called the Haunch-bone, Os *Ilium*, *λαγόν*.

π, 1, 2, 3. the second part the bone of the Coxendix *ισχίον*.

ρ, 1, 2, 3. the third part the share-bone, Os *pubis*, *ἡβης*.

σ, 1, 2, 3. a gristle going betweene the coniunction of the share-bones.

Δ, 1, 2, 3. the thigh, *μυελόν*.

τ, 1, 2, 3. the greater outward proceffe of the thigh called *Rotator*, *τροχαντήρ μέγας*.

υ, 1, 2, 3. his lesser and inner proceffe.

ζ, 1, 2, 3. the whirlebone of the knee, *Patella Rotunda*, *ἐπιμυελίς*.

Η, Σ, 1, 2, 3. the leg, *μυελόν*.

Φ, 1, 2, 3. the inner and greater bone of the legge, *σφυρημιον*.

Ψ, 1, 2, 3. the vtter and smaller bone of the Legge, called the *Bract-bone*, *Fibula*, *περὶν*.

φ, 1, 2, 3. the proceffe of the Leg or the inner ankle called *Malleolus internus*.

X, 1, 2. the proceffe of the brace of the out-ward ankle, both of them are called in greeke, *σφυλόν*.

Ω, 1, 2, 3. the bone called the cockall, *Talus*, *balista*, Os *ἀσφάλαιον*.

α, 2. the Heele *Calx*, *πῆρνα*.

β, 1, 3. the bone called Os *Naviculare*, *ναυειδής*.

cc, 1, 2, 3. the wrest of the foot called *Tarsus*, consisting of foure bones, *ταρσός*.

d, e, f, 1, 2, 3. three inner bones of the wrest of the foot, called by some *χαλκοειδής*.

g, 1, 2, 3. the vtter bone of the wrest of the foote like a Dye, *κυβοειδής*.

bb, 1, 2, 3. the afterwrest of the foot called *Pedum*, by some *μεταταρσοί*.

ii, 1, 2, 3. the toes of the foot.

k, 1, 2, 3. the seed bones of the foot, called *oscula sesamina*, *σποσμοειδής*.

Table



Table 4. sheweth the Sceleton of the bones and gristles of a woman, that it may appeare all her bones are in proportion lesfer then the bones of a man. But in this Table onely those parts are marked with letters wherein a woman differeth from a man in her bones and gristles.

TABVLA IIII.

- A, The sagittall suture descending into the Nose, and diuiding the forehead bone, which is sometimes found in women, very rarely in men, but alwayes in Infants.
 BB, the Chest somewhat depressed before, because of the Paps.
 CC, the collar bones not so much crooked as in men, nor intorted so much vpward.
 D, the breast-bone perforated sometimes with a hole much like the forme of a heart, through which veines doe ranne outward from the mammary veines vnto the Paps.
 E, the gristles of the ribs, which in women are somewhat bony, because of the weight of the Dugs.
 F, a part of the backe reflected, or bent backward about the loynes.
 GG, the compasse of the hanchbones running more outward, for the wombe to rest vpon, when a woman is with child.
 HH, the lower processes of the share-bones, bearing outward that the cavity marked with K, might be the larger.
 I, the anterior commissure or coniunction of the share-bones filled vp with a thicke gristle, that in the birth they might better yeeld somewhat for Natures necessity.
 K, A great and large cavity circumscribed by the bones of the coxendix and the Holy-bone.
 L, The Rump or Coccyx, curued backward to giue way in the time of the birth.
 M, the thigh bones by reason of the largenesse of the foresaid cavity, haue a greater distance betwixt them aboue, whence also it is that womens thighs are thicker then mens.



Table 5. sheweth the Sceleton of a child new borne, wherein its bones are yet either gristly or membranous.

TABVLA V.

- a, A thicke and (for the most part) square membrane betwixt the bones of the forehead and the Synciput which filleth vp the parts betwixt them.
 c, the bone of the forehead diuide d into two equall parts by the sagittall suture.
 d, the separation of the lower Jaw into two bones.
 e, the Scaly part of the Temple bones, which in the middest indeed is bony, but in the circumference membranous.
 f, the other part of the Temple bone which waketh a part of the stony bone, where the hole of hearing is gristly.
 l, the sockets of the lawes made to receiue the teeth.
 mm, the body of the rackbone, distinct from his backpart.
 nn, the backpart of the rackbones, consisting of two broad and small bones, and of gristly processes.
 o, the Holy-bone made of five rackes with a gristle betwixt them.
 p, the Rump gristle.
 q, the breast-bone, gristly in the circumference, but in the middest compounded of many bones.
 rr, the large part of the Coxendix made of three bones, with a gristle betwixt them.
 s, the second part of this bone making the parts of the Coxendix and the share-bones.
 t, the third part behind, making the same parts with the second.
 u, the whirle of the knee which is gristly.
 x, the wrist of the hand which is gristly.
 y, the After-wrist of the foot gristly.
 z, Although all the Appendances of the bones in Infants are gristly, yet this z marketh the most notable, as those of the Arme, the Blade, the Cubis, the Hanch-bone, the thigh and the Leg.

Table 6. sheweth the Bones and Gristles
of an Embryo or untimely Birth.

The first figure sheweth the Embryo at 24
dayes old, already formed and proportioned,
when all the Bones are like to curdled cheese
or to Butter.

Fig. 2. sheweth the tender bones of an A-
bortive fruit, about 3 months old, which are
more gristly then they are in a child borne in
due time.

a 1. Betwixt these letters in that space which on
the top of the Scull is soft and membranous, the
Arabians call it *Zendeck*, and commonly it is
called *Fontanela*.

a 2. a thicke membrane which goeth betweene
the forehead bone and the bones of the *Syn-
ciput*.

b 1. the ends of the Arme gristly.

b 2. membranes betwixt the diuision of the
bones of the head where afterward the futures
are.

c 1. the soft appendances of the Ell and the
Wand almost separated from their bones.

d 1. the appendices of the thigh and the legge.

e 1. the bones of the after-wrest of the foot, al-
together gristly.

a 2. the nayles of the fingers which are conspi-
cuous euen in an abortive Infant.

TABVLA VI.

FIG. II.



FIG. I.



CHAP. IIII.

A brieft diuision and enumeration of all the Bones in the Body.

The diuision
of the Sceletos.
The Scull 8.
3 of hearing.



THE whole Set or Pack of Bones called *Sceletos* we deuide into three parts; the
Head, the *Trunke*, and the *Ioyntes*. The Scull which is called *Cranium* or *Calua*,
consisteth of eight bones, sixe proper and two common. The proper bones are the
Fore-head bone, the Nowle-bone, the two bones of the *Syn-
ciput*, and the two
Temple bones, wherein are contained the three small bones of the Eare, the Mallet or Ham-
mer, the Stithy or Anuell, and the Stirrup. The two common bones are the Wedge bone
and the Spongy or Syue bone.

The iawes 13
Teeth 32

The Face contains both the Iawes, the vpper and the lower. The vpper Iaw consisteth of
eleuen bones. The lower Iaw of two onely, vnto both these are 16. Teeth belonging, arti-
culated by way of mortize or by *Gomphosis*, of which foure are called *Incisores* the Shearers,
two are called *Canini* the Dog-teeth, and ten *Molares* or the Grinders.

The spine 28.

The Trunke is deuided into the Spine, the Ribs and the bone without a name. The Spine
hath foure parts: the Necke, the Backe, the Loynes and the Holy-bone. The Necke hath
seuen rackbones, which are called *vertebra*. The Backe twelue, the Loynes siue, and the Holy
bone 4. or 6, whose extremitie is called *Coccyx* or the Rump. The ribs are twelue on either
side, seuen true Ribs and siue bastard Ribs, to which are articulated on the foreside the Brest-
bone, aboue the Coller Bones, and on the backside the shoulder blades. The bone without
a name (and I thinke it better so to leaue it then to giue it an vnfit name) hath three parts;
the Hip, the Hanches and the the Sharebones.

The Rump.
Ribbes 24.
Brestbone 3.
Coller bone 2
Shoulder-
blades.

Arme 1.
Cubit 2.
The hands 54.
The feed-
bones.

The third part of the *Sceletos* is called the Ioynts, and there are two of them, the Hand and
the Foote. The Hand is deuided into the Arme, the Cubit and the Hand properly so called.
The Arme hath one Bone, the Cubit 2, called the Ell and the Wand. The Hand properly so
called is deuided into the Wrist, the Afterwrist and the Fingers. The Wrist hath eight
Bones, the Afterwrist foure, the fingers fifteen, to which you may adde the Seede bones
called *Sesamoidea*.

The thigh 1.
Leg 2.
Feet 52.

The Foote is deuided into the Thigh, the Legge and the Foote properly so called. The
Thigh hath on bone: the Legge two, one retaineth the name of the whole and is called
the Leg-bone *Tibia*, the other we call the Brace-bone, in Latin *Fibula*. The Foote properly
so

so called hath three parts, as had the Hand, the Wrist, the Afterwrist and the Toes. The Wrist which is called *Pedium* hath seven bones: the Afterwrist *Metapedium* five Bones: The Toes foureteene. To all these we may adde the bone of the Tongue called *Hyois* which hath no articulation with any other bone; and this is the brieft summe of all the bones in the body. Now we proceed vnto their particular History.

CHAP. V.

Of the Sutures or Seames of the Scull, and of the substance thereof.



Concerning the Figures or formes of the Head, we haue spoken before sufficiently in the fourth Chapter of the seventh Booke, and therefore here we will not stand either to repeate or enlarge this argument, but come directly to the bones of the Scull.

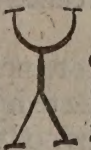
The Scull therefore is called in Greeke *κεφαλον*, in Latine *Caluaria*, and is that bone which compasseth the whole braine, being put vpon it as a Head-peece or Murrion, for more security and stronger defence, because vnderneath it, are contained so noble and necessary parts.

The Scull also for further security was made round and large, because it was to containe a great quantity of Braine and After-braine. It was not made of one bone for feare least by one wound it might haue been throughout cleft or fractured, but of many ioyned together by sutures or seames, as well for security as also to make the Head lesse subiect to offence: for were it not for these seames, in vehement motions the bones must needs start asunder.

The fashion of these Seames is of two sorts: the one plaine and linear like two boards glewed, or stones cemented together: the other indented like the teeth of two Sawes ioyned together, or like a loose seame of a garment when it is slackly sowed. It is very rare to finde the head without seames, although *Aristotle* report such a thing, as also *Pollux* in his second booke, *Herodotus* in his ninth, and *Columbus* vpon his owne experience. Sometimes we finde the *Coronall* suture to be obliterated, sometimes one of the other, sometimes in old bodies through length of time and drith all the seames do grow together by coalition, as doe the Appendances of bones, and their sutures are so abolished that scarce any footsteps of them do remaine, which in yonger bodies are most conspicuous.

Of all the Sutures saith *Falopius* those of the Temples do continue the longest. *Hippocrates de vulneribus capitis*, and *Galen* out of him doe say, that the sutures do change their position and number according to the different figures of the head, so that in those heads wherein the anterior prominence is wanting therein also is the *Coronall* suture absent; where there is no prominence in the Nowle there is no *Lambdall* suture: yet alwaies the *Sagittall* suture remaineth, and then the figure of the remaining sutures is like T. But where both prominences are wanting, there are 2. lines intersecting themselves through the Scull like X. *Columbus* for this reprehendeth *Galen*, and saith he hath handled sixe hundred thousand Sculls (he meanes a great many in some Church yard or Cloyster) yet neuer found any whose figure was not naturall, or which wanted either the *Coronall* or *Lambdall* sutures. *Falopius* also in this is against *Galen*, and so is *Eustachius*. *Bauhine* cannot approue it, for saith he we often find heads which want either the anterior or posterior prominence and yet haue all the sutures. Againe, some we finde without the *Coronall* sutures, when notwithstanding the fore head beareth out; some without the *Lambdall* suture though the Nowle be bunching: some without the *Sagittal*: some are found without any suture at all, though no prominence be wanting: not that these sutures are deficient from their originall or from the birth, but they are therefore abolished because they oftentimes grow together whether the head be well formed or no. For if the prominences were the cause of the sutures, then where there are no prominences there should be no sutures, but in the side of the head at the Eares where the Scull is depressed there are sutures without prominence.

The Sutures are called *σφαται*, and they are of two sorts; some are proper to the Scull itselfe, some are common to it with the vpper iaw. The proper sutures are againe double, True or False: the True are three, the False sixe. The common sutures are five. The true seames are two transuerse, and one lengthwise, so that together they make such a figure as this.

The first  or the anterior or the transuerse [ta. 7, AB ta. 9, fi. 11. m] is called *σφαταια*, The Coronall suture, because the ancients were wont to weare their crownes in that place; not such Crownes as Kings weare, but such as

Tab. 7. sheweth some bones and sutures of the head. Fig. 6. sheweth the left side. Fig. 7. sheweth the right side, the yoke bones being removed. See the description in Lib. 7.

at this day amongst vs, Gentlewomen doe weare, that is to say, Wyers, or Tyres of Haire, and oftentimes they lay some peece of Scarlet, or such like, vnderneath to defend the mould of the head, (for so wee commonly call it) from the ayer. This future resembleth a transuerse circle, for so it runneth ouerthwart about the forehead as farre as to the scaly agglutinations of the temple bones, and it separateth the forehead bone [ta. 7. L. from I. to K.] from the bones of the *Synciput*, or it ioyneth them together.

The *Lambdoides*.

The second or posterior future [ta. 7. C, D, ta. 9. P. P.] is in the backpart of the head, and ascending obliquely from the basis of the Nowle, to the rootes of the mamillary processes, at each eare determineth at the middest of the sagittall future. This future, because it is like the letter Δ is called *Lambdoides*. It separateth the nowle bone from the Bones of the *Synciput*, [tab. 7. M, from I K.] and the temple Bones. [ta. 7. N.]

But in those men whose Sculls are large behind this future is altered into others of diuers formes; sometimes the Bone is diuided by a transuerse future; sometimes it is circumscribed with a double future, as if a greater triangle should comprehend a lesser; sometimes with a treble, as if a greater triangle should comprehend two lesser; & these bones so circumscribed are by some called *Triangularia*, and are commended as of much auaille in the *Epilepsie* or Falling sicknesse. The third future is in the midst betwixt the former two, [ta. 7. fi. 1. R.] and commonly (as you may see in grown bodies) it runneth from the middle of the *Lambdoides* through the middest of the length of the head to the middest of the crowny future; sometimes it breaketh through it and diuideth the forehead bone, iust in the middest vnto the top of the nose, which is alwaies to be seene in Infants, in some children til they be 7 yeares old, in women but ordinarily, in men more rarely, and especially in those that haue flat faces. It is called *Sagittalis*, because it is straight like an arrow. It diuideth the two Bones of the *Synciput*; sometimes also (as we haue said) the forehead Bone, and sometimes it cutteth also a part of the nowle-Bone: And thus much of the two futures.

Sagittalis.

The bastard futures.

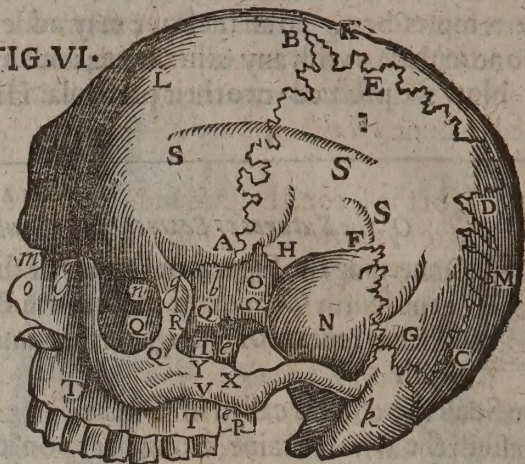
The first.

The Bastard futures are so called, because they be not so euident and conspicuous as the former, or rather, because they belong to the kind of seame which is plaine, lying as the scales of a Fish, one aboue another. Some reckon foure, others five, we with *Banquine* will account sixe. The first is at the sides of the cauities of the Temples on each side one. [tab. 7. F, G, H] It runneth with a circular passage vpward from the root of the mamillary proceffe and passeth downward vnto the basis. [tab. 7. fig. 6, from F, G, H, to Ω] These futures are not made by coniunction, but rather by superapposition, so that the Bone of the *Synciput* is by little and little attenuated like the plate of a mayle Iacke or scale of a Fish, and lyerh ouer the temple Bone. And therefore they are not simply called sutures but *Squamosae agglutinationes*, and *Squamiformes suturae*.

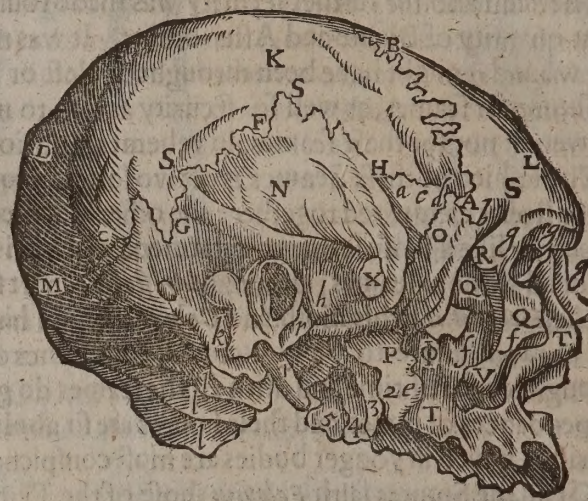
Now the reason why Nature ioyned the Bones of the *Synciput*, and the temples together like scales was, because she determined to place in the laterall parts of the temple bones the small bones of hearing, for which end she stood in need to make the bones of the temples hollow,

TABVLA VII.

FIG. VI.



VII.



hollow, whereas if both Bones had beene thicke there had beene no roome for the cavity, and beside the head would haue beene too heavy. Wherefore out of the great Bone of the temples being attenuated, is formed a cavity for the bones of hearing, and the other bone of the *Synciput* was also made thin, that it might more fitly be ioyned to the temple Bones. These two sutures do ioyn together on the foreside the temple bones with the wedge-bone; [table. 7, figure 6, N with α] but behind and aboue with the Bones of the *Synciput*.

The fift, or the second bastard suture [ta. 7, fi. 6, b] runneth likewise obliquely downward at the sides from the top of the former [ta. 7, fig. 6, from H to g] vnto the beginning of the first common suture; [at g] and this may be called *Cuneiformis*, the suture of the wedge-bone; for on the vpper part it ioyneth the wedge-bone with the Bones of the *Synciput*, on the lower part with the bones of the forehead.

The sixt suture [tab. 8, fig. 9, MM ta. 9, fig. 10, f] is on either side at the basis of the head; oblique also and continuall with the *Lambdall* suture, and runneth from the extremity of the same close by the roote of the mammillary proceffe through the middest of the stony bone obliquely inward to the basis of the head, where it is ioyned to the first rackbone as farre as to the transuerse line; but because it doth not so exactly expresse the forme of a suture, but seemeth rather a simple line, therefore some haue called it *Lambdoides Harmonialis*, others *Lambdoides inferior*, and *Galen* an additament of the *Lambdall* suture; and this suture or line is common to the Additament of the nowle with the lower part of the temple bone and the Organ of hearing. In children it is very manifest but in growne bodies by degrees it vanisheth away so that in old men there is no remainder or shew of it.

The seuenth suture [tab. 8, fig. 9, nn. tab. 9, fig. 10, t] is a line in the middle of the basis of the head which runneth on either side ouerthwart with a short course till it end into the chinke or rift which is common to the wedge-bone with the temple bone. This is common to the Additament of the nowle with the wedge-bone, and ioyneth together the end of the *Lambdall* suture.

The eight [tab. 9, fi. 10, uu] is most conspicuous on the inside of the Scull. It runneth ouerthwart on both sides in the forepart thereof, and reacheth to the lower angles or corners of the spongy bone and the cavities of the Nostrils. It is common to the forehead with the fore-part of the wedge-bone. Moreover it separateth the spongy bone on euery side from the forehead bone, which seeme rather to be ioyned by *Lineall harmony* or *Cementation* then by suture.

The ninth [tab. 9, fig. 10, from u by R I vnto x on the left side] on the outside almost in the middest vnder the spongy Bones of the Nostrils appeareth foure square, and runneth obliquely according to the forme of the wedgebone, so that it is common to the spongy bone as it is referred to the Scull: on the backpart with the wedge-bone, on the forepart and in the sides with the forehead bone: and these are the six bastard sutures which with the three true sutures make nine proper sutures of the Scull.

The Sutures which are common to the Scull with the bones of the vpper Iaw whereby the processes of the bones of the Scull are fastened on the outside are accounted five.

The first is in the outside of the eye-brow, [ta. 7, fig. 6, 7, gg ta. 8, fig. 8, R; fig. 9, g,] and runneth outward from the end of the fift suture and the second common suture, and expresseth the right forme of a suture indeed, and it is common to the bones of the forehead and the first bone of the vpper Iaw.

The second which *Archangelus* maketh a proper suture of the Scull and *Columbus* accounteth for the sixt, appeareth in the vtter and laterall part of the orbe of the eye, and as if it were double is distinguished with a long common perforation; aboue it runneth downward [tab. 8, fig. 8, from S to Q, and fig. 9, to d. table 7, fig. 7, to d] from the outside of the orbe of the eye and the cavities of the temple bones vnto the foresaid perforation, and becommeth common to the wedge-bone with the first bone of the vpper Iaw, which maketh the outward angle; below it runneth directly downeward at the sides of the Pallate and the cavity of the Nostrils from the foresaid perforation euen vnto the roots of the teeth, [table 8, figure 9, from d to e] and is common to the wedge-bone with the fourth and sixt Bones of the vpper Iaw.

The third, which *Columbus* accounteth for the eight, is seated in the inside of the orbe of the eye and the cavity of the Nostrils, and runneth obliquely outward from the roote of the eye to the top of the Nose, [table, 8, fig. 8, R S T V X Y Z] and is common below, by a short

See this description, lib. 7. cap. 4.

short cut to the protuberation of the wedge-Bone with the third Bone of the vpper Iaw; the rest of his passage ioyneth the outward table of the forehead-Bone, with the second, third, fourth and fift Bones of the vpper Iaw.

The fourth.

The fourth belongeth to the Yoake-Bone, and runneth obliquely through the middest thereof, [tab. 7. fig. 6. r. ta. 8. fig. 9. r, fig. 8. p] and ioyneth the proceffe of the temporall Bone with the proceffe of the first Bone of the vpper Iaw.

The fift.

The fift is below in the cavity of the Nostrills, and runneth [tab. 8. fig. 9. under $\equiv$] from behinde forward betwixt the Processees called the *Bats-wings*, and is common to the wedge-bone, with the partition of the Nostrills. It is also to be obserued that all the coniunctions of the Bones of the head, which outwardly are sutures, on the inside do rather seeme to be ioyned by *Harmony* or *Cementation*, then by suture: on the contrary, saith *Eustachius*, in the Scull of an Ape they are each where so obscure, that for the most part they do not deserue the names of sutures. In some men also they are greater and more loose, in others smaller and more compacted.

The first sort are lesse troubled with paines in the head from internall causes, albeit *Celsus* in the first Chapter of his 8 booke, is of another mind; neither ought any man to wonder much thereat, because Anatomy in his dayes was but in the Infancy, and beside, that kinde of learning among the Romans was but geazon: the other whose sutures are more compacted, are obnoxious or subiect to continuall and great paines of the head, because the footy excrements are retained, which with their acrimony or sharpnesse doe goad the membranes, and with their abundance distend them.

The vses of the sutures.

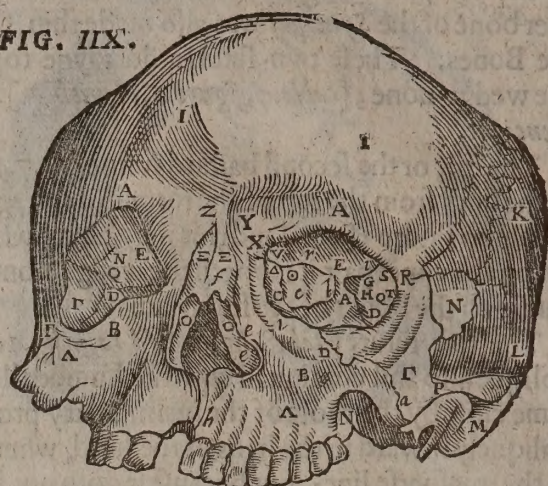
The vses of these sutures are; first to be vents of the braine, that the thicker and footy excrements might exhale. But this was not the onely vse, for then the Scull might have been bored through with small perforations to haue serued that turne; but it was necessary that the *Dura meninx* should issue forth and be suspended to the Scull, lest the hardnesse thereof should presse the braine or the ventricles therein: beside those Filaments or strings doe make the *Pericranium*, and the *Periostium*. Furthermore, the sutures were made for the ingresse and egress of vessels for the nourishment and life of those parts.

Fourthly, that if at any time the head should happen to be broken, the fracture might not run through the whole Scull, but stay at the end of the fractured bone. Otherwise if a fracture were made in the forepart, the fissure or cleft would passe in the continuation of the Bone vnto the hinder part, as it will doe in an earthen pot. Finally, Nature found it needfull that some parts of the scull should be thicker, others thinner, some of one forme some of another; and therefore she thought it fit, rather to make it of many Bones, and to ioyne them together by sutures, then to make it of one onely Bone, which must haue had so great variety of parts. We may also adde with *Galen*, in the 22 chapter of the 13 booke, of his Method, and *Falopius* maketh it the 7 vse; that medicines which are to bee applyed outwardly might better enter into the braine and affect it. And thus much of the sutures.

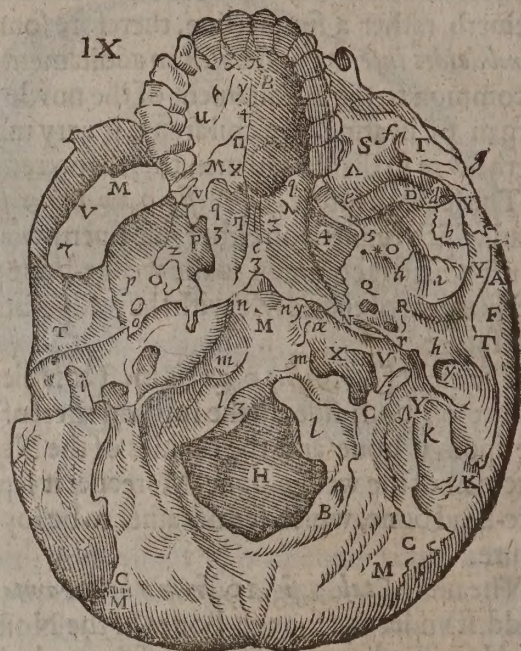
The

TABVLA VIII.

FIG. IIX.



IX



The substance of the Scull varieth according to the age of the party. For in children new borne it is very soft, afterward it is gristly and membranous, especially about the commissures or seames [ta. 3, ta. 4, fig. 1, betwixt a and b, especially ta. 4, fig. 2, betwixt a and a] and in the vpper and middle part of the head; so that in some children till they haue passed ouer some yeares it will yeeld to the compression of a mans finger. And this tenuity or softnesse of the Scull was very necessary, both to make the birth of the infant more easie, as also for the growth of his head.

The substance
of the Scull.

But in growne bodies it is altogether bony for more strength; yet not thin, for then the parts contained vnder it would not haue been so wel secured, for a light violence would easily haue penetrated through a thin bone: nor yet fast and thicke, for then it would haue beene too great a burden; and therefore it was made neither fast nor thin, but thicke, rare and cauer-nous or full of holes. [ta. 9, fig. 11, 12, L ta. 10, fig. 14, c] Thicke for security and strength, and rare that it might not be a burden, porous also for Transpiration.

It is made of a double scale [ta. 10, fig. 14, a o] which some call *Diploas* or *Laminas*, we will call them Tables, which are most manifest in the bone of the Forehead, in the Temple-bones, in the Wedge-bones especially about the browes, or where the Scull was to be made thicke, as aboue where there is no flesh; below in the Basis especially about the perforations and the cauities to strengthen them. The Tables although they be hard and somewhat thicke, yet the vtter may sometimes be eaten away by the French discale, and the Patient recover notwithstanding.

The double
table.

Betwixt these Tables [ta. 10, fig. 14, betwixt a and o e] there is a substance which some haue compared to a Pumy stone, fungous and fistulated manifold, not onely to make the Scull the lighter, but that in the cauities and pores thereof a marrow might be contained, in which marrow the bloud and spirits which are powred into it out of the veines and arteries thither ariuing, is boyled for their nourishment, and this the Anatomists call *Meditullium*. In other parts although it be thin, yet is it hard and solid, as about the Temples where it is very thin indeed and giueth way to the Temporall muscles, in the cauity also of the eye where notwithstanding aboue and below it is duplicated.

The outward surface of the Scull is almost euery where equall and smooth, least it should hurt the *Periostium* wherewith it is compassed: yet in the margents or edges of the forehead bone, and aboue the cauity of the eyes it buncheth somewhat out for more strength: againe, at the sides of the Temples, the bones are compressed for the behoofe of the Temporall muscles, and in the Nowle it is exasperated with small knots or bunches made for the insertions of the muscles. The lower side or the Basis is very vnequall, and rough by reason of the many processes, cauities and swellings of the Bones, all which we shall make mention of in their particular History.

The surface.

The *Internall* cavity is also for the most part smooth, that the *Dura meninx* whereby it is compassed might not be offended. In the top as it were of the Helmet it hath shallow cauities, in the forehead bone and the Bones of the *Sinciput*, whereto the *dura Meninx* doth grow, and inscriptions also or lines for the courses of the veines: but below there are diuers productions, extuberations, and small bosomes made to receiue the different figures of the parts of the Braine, the After-braine and the instruments of the Senses.

The inner
cavity.

Both Tables are perforated with many small holes, thrilled not in order but wildly and as it were at aduenture, and those transuerse or oblique, through which small veines and arteries do passe into the cauity of the inner bones and the *sinus* of the *Dura meninx* or hard membrane.

Perforations.

Moreouer the small cauities or dens that are in either Table doe make way for the Transpiration of subtile and thin vapours, which if they be retained do breed giddinesse and other diseases. For the head is set aboue the rest of the parts as a rooffe vpon a house that is kept hot but without a chimney: whose rafters, because the smoake hath no vent, will become black and sooty. Beside these, most bones of the head haue their proper perforations, cauities, *Sinus* or bosomes & processes, of which we shall speak in the particular History of each bone.

CHAP. VI.

Of the proper Bones of the Scull.

THE Bones of the Scull are of two sortes: some belong to the Scull it selfe, some to the law, which is double, the vpper and the lower. The bones of the Scull in growne bodies are commonly 14. whereof some are proper others are common. The pro-
per-

The diuision
of the Bones
of the Scull.

per bones are in like manner of 2 kinds, some make the circumference of the scull, and these are commonly accounted fixe. The fore-head bone, the two Bones of the *synciput*, the Nowle-bone and the two Temple-bones. The other serue onely for the sense of hearing which likewise are six, three in each Temple-bone called the Hammer or Mallet, the *Stirrup* or Anuile, and the Stirrop. The common Bones of the scull are so called, because they are common to the scull and the vpper iaw, and these are two, the wedge-bone and the spongy bone. In children new borne the Bones of the scull are 22, two of the fore-head, two of the *synciput*, foure of the Nowle, two of the Temples, two Labyriaths, six of the Hearing, one wedge-bone, one spongy bone, and two without names.

The forehead
bone.

The first is the fore-head bone [tab. 7. fig. 6, 7 L. tab. 8. fig. 8, 11] seated before, for it maketh the forepart of the scull both aboue and below, and the whole forehead, and the vpper part of the orbe of the eyes. It is tyed aboue to the bones of the *synciput* [tab. 7. fig. 6, 1 K] by the *Coronall* suture; [tab. 7. fig. 6 C fig. 7, AB] belowe, partly to the bones of the scull as the wedge-bone, and on the outside to the bones of the Temples by the *scale-like* suture; [tab. 7. fig. 6 and 7 Ag] on the inside by the eight suture, [table 9. figure 10. T u] as also to the spongy Bone which it doth as it were encompasse by the ninth suture: [table 9. figure 10. from u toward K I] partly it is committed vnto some Bones of the vpper iaw, to the first in the vtter angle of the eye by the first common suture. [table 8. figure 8, R Table. 7. figure. 6 and 7 g] againe in the cavity of the orbe of the eye, to the second, third, and fourth bones; [table 8. figure. 8 S, T, V, X] and to the fift in the top of the nose [table. 8. figure. 8. XZ] by the third common suture.

This forehead Bone in growne bodies is but one, very rarely two [table. 3 c tab. 6. fig. 2 aa] though it be alwaies so found in new borne infants, distinguished by the *sagittal* suture; sometimes it continueth so to the seuenth yeare, but is afterward obliterated, the bones growing together. The figure of it is after a sort circular. The substance in a meane betwixt the Bones of the *synciput* and the nowle-bone. In infants that part where it is committed with the bones of the *synciput* and meeteth with the *sagittal* suture, is very thin, and in new borne infants [Table 9. figure, 11 R] but onely membranous, in growne bodies it is more thin and infirme in the cavity of the eyes and where it is ioyned with the eight Bone: in some places also it hath two transparant shels or scales. Toward the sutures it is thicker, that it might fasten more strongly with other bones, as also at the toppe of the nose and aboue the eye-browes, where it is diuided as it were into two partes to make a *sinus* or Denne.

The canities
thereof.

For betwixt the two Tables aboue the Nose in the Region of the Eye-browes, there are large canities for the most part two, [table 9. figure 10 and 11. L] one on the right hand, another on the left, which are distinguished with bony Fibres and small scales. Sometimes also, they are separated and encompassed with a greene Membrane, which containeth a soft medullous and as it were an oily body. In these bosomes there are perforations which determine partly into the cavity of the nosethrils, and one [tab. 9. fig. 10. aboue x] which endeth into the scull presently aboue the partition [tab. 9. fig. 10 x 1 a. 10. fig. 12 B] of the spongy bone, whereby the organs of Smelling are distinguished. But these bosomes are not found in those that haue flat faces and saddle noses, neither yet where the forehead is diuided. They were formed to make the voice more shrill, and thence it is that such as speake in the nose haue them not.

Why some
speake in the
Nose.

Their vses.

Again, they were made to containe the aire which is drawne in by the nostrils, that being alread it might first be conueyed to these bosomes, and from thence by degrees to the organs of smelling and so vnto the Braine to make alteration therein: they serue also when the Braine is affected to reduce it vnto his naturall state, as when for a moist Braine we appoint a Pomander wrought vp with Muske and Amber-greece; the Muske and Amber warmeth the aire that is drawne in by the Nosethrils and conueyed to these bosomes; and hence it is that oftentimes an odour that is drawne in by the Nosethrils remaining in these canities, is felt a whole day together in the top of the Nose. Some thinke, as *Archangelus* and *Piccolthominie*, that the matter contained in them somewhat like vnto Oyle, passeth through the perforation that is in the greater angle of the eye, and moisteneth the same, whereby it is made glib and his motion more quicke and speedy.

Pomanders.

The Den.

Beside these, there is also a Denne made of a double scale, the vtter scale maketh the vpper part of the Orbe of the eye [table 8. figure 8, aboue E,] and is plaine; the inner maketh the cavity aboue the eyes on either side [tab. 9. figure 2. Z] and is not plaine but hath inscrip-

tions

tions answerable to the winding convolutions of the Braine, whose protuberating portions it receiveth. A *Sinus* also runneth through the midst of this Bone, as farre as to the spongy bone, which was made for the third *sinus* of the *dura Mater*, to giue way vnto it that it should not be pressed by the forehead bone.

The perforations.

Holes it hath in the place of the Eye-browes, sometimes two, sometimes three, and three beside peculiar vnto it, one on the inside in the coniunction of the spongy bone with the forehead bone where it passeth into the sinus, of which we haue spoken before. Beside two on the outside at the middle of the browes, on either side one [tab. 8, fig. 8, AA] which is sometimes orbicular, sometimes long, and endeth into the orbe of the eye; thorough which a branch of the Nerue of the third coniugation is transmitted out of the orbe of the eye to the muscous skin of the forehead, haply also vnto the Muscles of the eyeliddes, whence it is that oftentimes when a man rubbes his forehead he will sneeze vpon it.

Finally, the forehead bone sendeth forth two processes, one vnto the lesser, another to the greater angle of the eye, which make the vpper brimmes of his orbe: and so much of the forehead Bone.

His processes.

The bones of the *synciput* are so called, saith *Arch. Angelus* of *our before*, and *Caput the Head*, because they make the anterior or forward part of the head. In Greeke they are called *ὀστέα βρεχυνάσια*, which word *Eustathius* vpon *Homer* acknowledgeth to be given, because in Infants that part is not onely tender but very moist: or rather saith *Bauhine*, because thereunder lyeth the moist and soft Braine. They are called in Latine *Ossa verticis*, because they make the heighth or top of the head: [ta. 7, fig. 6, IK] also *Parietalia* the Wall-bones, and by *Volcher*, the *Bones of Reason* or *Discourse*.

The Synciput.

They are two ioyned together in the midst of the length of the head by a suture common to them both, called *Sagittalis*: [ta. 7, fig. 6, A] and so ioyned make the vpper part of the scull, as also the sides for the most part as farre as to the eares. They are fastned also to the adjacent Bones, on the fore side to the forehead bone by the coronall suture, [ta. 7, fig. 6, AB] behinde to the *Occiput* or *Nowle* by the *Lambdall* suture [ta. 7, fig. 6, D e] on either side to the Bones of the Temples by the scaly sutures, [ta. 7, fig. 6, G F H] and finally to the wedge-bone by a part of the fift suture. [ta. 7, fig. 6, and 7, H, A]

Their forme is almost foursquare and almost equally thicke, sauing that they are attenuated where they are ioyned to the Temple-bones.

Forme and substance.

Their substance in growne bodies is hard and solid, yet in respect of other bones very rare and weake, and this haply is the reason why wounds in the *synciput* are most what mortall. In infants (for I speake not now of Beasts but of men) the anterior part of these Bones where the *Sagittall* suture is ioyned with the *Coronall* [Table 7, figure 6, B N] is Membranous and hardneth by degrees, and the two Bones do grow together and are indurated last of all the Bones of the Head, and some haue thought as *Aristotele* and *Pliny*, that it is not possible children should speake, before the whole scull bee become Bony.

Because of this softnesse when the Bones are not yet so well growne that they can cover the whole Braine, you may obserue about the crowne of the head as it were a breach or Den, [tab. 9, fig. 11 T. tab. 6, fig. 11, aa] which the Arabians call *Zendeck*, the Barbarians because of the moysture and pulsation do call it *Fons pulsatilis*, the beating fountaine. Others call it the *Fontanel*, and indeed in that place at this day we vse to apply Cauteries, and the Ancients vsed red-hot frying pans in fits of the Apoplexy, for so I may call the instruments with good warrant: if you would know the very place of this coniunction in a liuing body, let him lay the roote of the palme of his hand betwixt his browes, and the middle finger will designe the iust place.

The breach betwixt them.

These Bones haue on the inside superficial cavities or small Bosomes, to which the *dura Meninx* growes, as also inscriptions [tab. 9, fig. 10, and 11, SS] for the vessels which run from the internall iugulars through the thicke Membrane of the Braine. They haue also some smal perforations, especially outward at the sides of the *Sagittall* suture which perforate the bone from one side to another, and transmit small veines for nutrition.

The Bone of the *Occiput* or the *Nowle*-bone [table 7, figure 6 and 7 M, tab. 8, figure 9 M M] is called *Occiput*, of *Oc* for *Ob* and *Caput*, because it is behind the head. Some call it *Os basilare*, the Arabians *os Prora*, and *os Memoriae*, as if the memory were seated in it. The situation of it is behinde, and it maketh the backward and lower part of the Scull and the middle

The Nowle-bone.

dle part also of the Basis. *Platerus* saith it is alwayes one, but saith *Baubine* I haue a Scull wherin it is made of three bones, and *Eustathius* maketh mention of the like.

In children till they come to the end of the first yeare it consisteth of foure bones, one above, which maketh the greater part of the capacity, and in some bodies is diuided in the middest by the sagittall future. Another below, vnder the great perforation which they call his additament; at the sides of that perforation are the 2. other very thin bones and gristle-bound or vnited by *Synchondrosis*, for they are deuided by lines filled with a gristly substance; which becomming in time harder is turned into a bone. It is fastned about to the bones of the *sinciput* [table 7, figure 6, I K] by the *Lambdall* future, [table 7, figure 6, C D] at the sides of the Temple bones by the additaments of the same *Lambdall* future, or by the sixt future, [table 8, figure 9, m c] and in the middest of the wedge bone [table 8, figure 9, 00] by a transuerse line or future, or by the seuenth future which is common to it with the wedge bone [table 8, figure 9, n n.]

His connexion.

Figure.

Substance.

The figure of it is almost round or rather *diangular*, consisting of two circular lines which end into sharpe determinations.

The substance is hard and fast about all the bones of the Scull, and thickest as the *basis* where it is without flesh, and where two *sinus* of the *Dura meninx* are ioyned, [table 9, figure 10, vnder fgh] for it behoued well that it should be stronger then the forehead bone, because it is behind where it could not so well haue been attended vnto. At the sides of the great perforation [table 8, figure 9, H. table 9, figure 10, d] it is somewhat thin, (*Aristotle* saith the thinnest of all bones, but he mist his marke) and without any canities or small dens therein, but in the middest (to strengthen it the more because of his thinnesse) there ariseth and runneth a long prominence [tab. 9, fi. 10. at h] throughout, to secure it if by chance a man should fall backward.

Sinus nine.

It hath nine *Sinus* or Bosomes, 7. on the inside, of which two are partly oblique and partly transuerse: on each side one which climeth obliquely vpward and backward through the temple-bones, [tab. 9, fig. 10 from b towards q] presently runneth ouerthwart [tab. 9, figure 10, and 11. about h] and so they meete in the middest of the Nowle. They are made to receiue two *sinus* of the *Dura meninx* that they should not be compressed by the bones of the Scull.

The third *Sinus* is right, straight, and from the congresse of the former runneth directly vpward, and vnder the *sagittal* future, and the middle of the forehead bone attaineth vnto the spongy bone, [tab. 9, fig. 9, at h] and this *Sinus* was exculped or grauen in the bone for the third *Sinus* of the *Dura meninx*.

Their vse.

There are two other bosomes seated about the transuerse, and distinguished by a right line. Their vse is the better to receiue the Braine, which is double. There are yet two other large *Sinus* in the *Basis* below the transuerse, [tab. 9, fig. 10, g] which receiue the protuberations of the After-braine, and these are the seuen *Sinus* on the inside.

On the outside there are two semicircular, made to receiue the two *anterior* processes, [tab. 8, fig. 9, ll]

Their perforations.

The perforations of the Nowle-bone are five: the first [tab. 8, fig. 9, H. tab. 8, fig. 10, d] is in the middest of the *Basis* of the Nowle. The largest of all the inward holes of the head; it is round but somewhat long, through which the marrow of the braine falleth into the spine. It hath also two other perforations [tab. 8, fi. 9, F. ta. 9, fig. 10, b] common to it with the temple bone, on either side one betwixt the head of the Nowle [table 8, figure 9, betwixt l and i] and the appendix *Styloides*. These are notable and long perforations, and seeme as it were double, for through it in the lower and vtter part doth passe the greater branch of the internall *Angular* veine, and the lesser branch of the sleepey artery: againe, through the vtter and inner part passeth the sixt coniugation of Nerves.

Two other proper perforations it hath [tab. 8, fig. 9, tab. 9, fig. 10, c] which are neare vnto the first, running obliquely inward and are orbicular: yet sometimes they are long for the transmission of the seuenth coniugation of sinewes which is presently ioyned to the sixt; sometime also it transmitteth a veine and an artery. Sometimes there is yet found another perforation on either side in the vtter part of the head of this bone [tab. 8, fig. 9, B] which is not very large because it runneth a long course before it get within the Scull. Some thinke through it there passeth a veine and an artery which did climbe vp the transuerse processes of the Rack-bones: but saith *Baubine* we finde this perforation wanting oftentimes on one side, sometimes on both, and then these vessels passe through the two holes last before mentioned.

On

On the outside at the Basis, the Nowle-bone is rough and vnequall, as well for the Original, as for the infertion of the Muscles and ligaments.

His processes or heads (for so we called them even now, and according to *Platerus*) are two, [*tab. 8. f. 9. ll*] broad before, and in infants they haue an Appendix covered also with a gristle, and protuberation more inward then outward, which processes are inferted into the Sinus of the first rack-bone to helpe the motion and articulation of the head. On the backside there ariseth a small processe which is receiued by the first rackbone.

Finally, in dogs from the nowle bone proceedeth another triangular bone sinuated, which goeth betwixt the braine and the After-braine.

The temple bones called *ἰσχυρότερον*, are called by diuers names, *Ossa lapidosa*, *Saxea*, *Parietalia*, *Dura*, *Arcualia*, *Squamiformea*, *Squamosa*, *Menäosa*, [*tab. 7. f. 6. and 7. N. tab. 8. f. 9. TT*] their principall part is about the sides neare the eares, part of them also is in the basis. In growne bodies they are two, on each side one, but in children each bone by the interposition of a gristle is parted quite through the auditory passage. The footsteps of which diuision doe yet remaine at the entrance of that passage. They are conioyned aboue with the bones of the *Synceput* by a proper Scaly suture, [*tab. 7. f. 6. and 7. G. E. F*] sometimes also with the forehead bone below, and on the inside with the Additament of the nowle-bone by the sixt suture; [*tab. 8. f. 9. mn*] in like manner with the wedge-bone: before that is, at the sides, it is ioyned by that suture by which the stony-bone is annexed to the same wedge-bone, [*tab. 7. f. 6. from a to H*] but in the basis on the outside where the cleft is, they are parted asunder. [*tab. 8. f. 9. from n to o*] Finally, they are ioyned with the first bone of the vpper iaw; [*tab. 7. f. 6. r*] I meane their processe which is called *Iugalis* or the yoke (for that is a processe of the temple bone) by the fourth common suture.

The temple bones.

The Con-
nasion.

Their figure is aboue ample, round and semicircular, but below it hath no shape but seemeth like a rude rugged and vnequall Rocke.

Their figure
and substance.

The substance is also full of variety, for at the basis they are thicke and rough like Rocks whence they are called *λιθονειδῆς*, *Petrosa*, *The rocky or stony bones*. Ascending they are by degrees attenuated, so that they were not so thicke at the basis, but they are as thin at the top, yea transparent; especially where they giue way to the temporall muscle, and like scales are adioyned by the second kinde of suture to the bones of the *Synceput* which in the descent are attenuated to receiue them: and though the height of the temple bone be but thin in respect of his basis, yet it is harder and faster then the bone of the *Synceput* vnder it, to which it is a kind of defence, and therefore cannot be broken without danger of death, although *Columbus* make mention of two children cured of fractures in that place, the one at *Padua*, the other at *Rome*.

Moreouer if these bones had beene equally thicke throughout and not attenuated toward the top, their very waight, if nothing else, would haue beene burthensome. On the outside they are solid, smooth, and plaine; on the inside because of the conuolutions of the braine it hath many rising inscriptions. Againe in the basis of it we shall finde one Appendix, three Processes, eight Perforations, and two Sinus or cauities, of which we will speake in order.

Parti.

The Appendix is sharpe, long, and slender, and a little incurued like a Cocks spur. [*tab. 7. f. 6. and 7. i. tab. 8. f. 9. ii*] It is commonly called *Styloides*, sometimes *Belenoides*, *Graphoides* and *Plectrum*, that is, the *Bodkin*, the *Needle*, the *Pen*, and the *Cockspur*. In children it is gristly, in growne bodies solid and hard, but because it sticketh farre out, a little thing will breake it off, which is the reason why we finde it so seldome in Sculls gotten out of the ground, yea a little seething will make it fall away.

Appendix.

From this Appendix proceed the muscles which go vnto the bone *Hyois*, the tongue and the lower iaw to draw them downeward, yea the bone *Hyois* it selfe groweth thereto by the interposition of a ligament. So much of the Appendix.

The first processe is on the outside blunt and dull tending downward on each side one, which because they are like the nipple of a Cow are called *Mastoides*, *mammillares*. [*table 7. figure 6. and 7. K. table 10. figure 8. M. fig. 9. K*] It is a thicke processe, spongy within and somewhat hollow, it may be for more lightnesse, and it serueth for the infertion of the muscles which bend the head; wherefore it is rough and like a Rocke. The second processe runneth forward from the hole of the eare to the processe of the first bone of the vpper iaw to helpe to make the bone called *Iugall* or the yoke bone, for these two processes one of the Temple-bone, the other of the first bone of the vpper iaw being ioyned with an oblique

The Bones of
Hearing, and
the Cavities
of the Stony-
bone.

oblique future doe make the fashion, as it were, of a Bridge, or of a Yoke. [tab. 7 f. 6 & 7, V X, ta. 8 f. 8 at P] The third proceffe is on the inside [ta. 9 f. 10 a] and stony, swelling out in length; wherein there is a triple or threefold cavity. The first is called *Tympanum*, the *Drum*, the second, *Labyrinthus*, the *Labyrinth*, the third, *Cochlea*, the *Snailshell*; where also there are three Bones of hearing, all which, because they were made for that sense we haue handled particularly; the cavities of this stony-Bone in the 20, 21, and 22 chap. of the 8 Booke, as also the three bones of hearing in the 18 chap. of the same Booke, where he that listeth may find abundant satisfaction, at least so farre as we could serue his turne, for wee haue handled them there very particularly. The third proceffe in Infants is called, *The Bone of the Labyrinth*, because it lyeth vnder the scaly Bones, and is so straightly fastned vnto them that at length they vnite; so it changeth his name, and is called the interior proceffe of the Stony Bone. So much for Processes.

The perfora-
tions.

The Perforations are of two sorts, fixe externall and two internall, which doe let something in, or send something forth, or both. The first externall perforation which *Platerus* calleth, *The third of the Temples*, and the first of *Hearing*, [ta. 8 f. 9 y] is very large betwixt the Mammillary proceffe and the Iugall or Yoake-Bone, because it intromitteth or giueth way to the entrance of ayre and sounds. It is called by a proper name, *Meatus Auditorius*, the hole of *Hearing*.

The second perforation which *Platerus* accounteth for the first of the Temples, is in the backside, neere to, but behind the Mammillary proceffe [ta. 6 f. 9 x] and entreth into the cavity of the Scull at the transuerse and round side of the *Lamddal* future.

This perforation is sometimes wanting in one side sometimes in both, but when it is there, a branch of the externall veine passeth through it.

The third perforation which *Platerus* accounteth for the second of the Temples, is at the stony proceffe [tab. 8. f. 9 X] vnder the appendix, called the *Bodkin*, or *Styloides*. It is a great hole, vnequall, and runneth oblique from behind inward and forward, through which the greater branch of the Sleepy artery runneth obliquely vnto the fist hole of the wedge-bone, and from thence into the Ventricles of the Braine; by it also issueth a portion of the third Coniugation of sinewes. It was bored slante or oblique, that it might more safely passe without breaking from behind forward. Some thinke the cause of the obliquity was, that the spirituous bloud might there make a certaine stay.

The fourth hole, which *Platerus* calleth the fourth of the Temples, and the second of *Hearing*, is likewise oblique, double and short. [tab. 8 f. 9 V] It intromitteth the Iugular veine, and sometimes transmitteth a small branch of the Auditory Nerue.

The fift, according to *Platerus*, the fift of the Temples and the third of *Hearing*, is betwixt the Mammillary proceffe, and the appendix *Styloides*, a round perforation, and determineth into the long Canale. It intromitteth the sleepy artery, and giueth way vnto the egress of a Nerue.

The sixt, according to *Columbus* the fift, is betwixt the Nowle and the Temple-Bone, great and vnequall, and bored for the egress of the sixt Coniugation of sinewes, and the ingresse of the Internall Iugular veine vnto the Braine.

The seuenth, the sixt according to *Platerus* of the Temples, and the fourth of *Hearing*, is bored in the backside of the proceffe, [tab. 9 fig. 10 a] it is long, and as it were ouall, dilated by degrees, and runneth with a blind passage (from whence it is called *Foramen cecum*, the blinde hole) into the *Labyrinth*: into this hole the Auditory Nerue of the fift paire doth passe.

The eight, according to *Platerus* the seuenth of the Temples, and the eight of *Hearing*, is in the foreside of the proceffe; [tab. 9 f. 10 against a] a narrow perforation, and rugged like a rift, and it transmitteth from the Organ of *Hearing*, a small Artery into the Capacity of the Scull. And thus much of the perforations.

The Sinus.

The *Sinus* or Cavities of the Temple-bones are two. One outward [tab. 8 f. 9 b] betwixt the hole of *Hearing*, and the proceffe of the Yoake-bone: it is a long Cavity, transuerse and crufted ouer with a Gristle, and into it the longer proceffe or the head of the lower Jaw, is inserted and articulated, and this *Sinus* saith *Columbus*, *Galen* in his Booke *De Ossibus*, hath not rightly described. The other bosome or cavity is inward, at the backside of the proceffe, long and oblique, and common to the Temple-bone with the Nowle-bone. [tab. 9 fig. 10 from b toward i] And thus much of the proper Bones of the Scull.

CHAP. VII.

Of the Bones that are common to the Head and the vpper Iaw, that is to say, of the Wedge and spongie bones.

THE first Bone that is common to the Head and to the Iaw, is called *Sphenoides*, either because it is like a Wedge, sharpe above and thicke below; or rather for that like a Wedge it sticketh betwixt the Bones before named and those of the vpper Iaw. The Interpreters of the Arabians call it by diuers names, *os Paxillare*, *Colatory*, *Basilare* and *Canilla*. It is seated in the middle of the basis of the Head, yet so as that it toucheth almost all the bones of the head and the vpper Iaw. It is ioyned before, to the fore-head bone by the eight transuerse suture, [tab. 9, fig. 10, from T to u] to the spongie bone on the inside by a portion of the ninth suture; [tab. 9, fig. 10, at the middle u] On the outside at the cavity of the nostrils, to the partition by the first common suture; [tab. 8, fig. 9, neere z] behind, to the additament of the Nowle-bone by the seventh suture; [ta. 8, fi. 9, nn] at the sides to the temple bones by the scaly suture; [ta. 7, fig. 7 a] to the angle of the Bone of the *Synceput* by the fifth Suture, [tab. 7, fig. 6 and 7 from H to A] and to the forehead bone by the same suture. [from A to g.] It is also ioyned by his eminences or processes to the bones of the vpper Iaw, as on the inside, with the orbe of the eye, with the third Bone of the Iaw by the third common suture. In the outside with the first, fourth and sixth Bones of the vpper Iaw by the second common suture. [ta. 8, fig. 8, from S to Q, and fig. 9 from d to e]

The Wedge-bone.

Connexion.

In growne bodies it is but one bone, yet at first is compounded of foure Bones, with a Gristle betwixt them, which (saith *Falopius* in his Obseruations) do not appeare distinguished after the seventh month but are vnited. The first of these foure is the basis, in the middle almost of the head separated by a transuerse line from the end of the additament of the Nowl-bone, and it containeth the Pituitary Phlegmaticke Glandule, and because it is like a saddle, is called the saddle of the Wedge-bone. [tab. 9, fig. 10, B]

His parts.

The second part of the wedge-bone hath no name, and is destined to beare vp the vnition of the Opticke nerues, [ta. 9, fig. 10 D] and is coupled to the first with a plentiful gristly substance; toward the palat there is in it a bony naile, whereto is fastned a long and broad bone which is gristly in the originall, and is like to the Cowlter that ruaneth before the Plowshare. The third and fourth parts of this bone are two processes, on either side one like to wings [tab. 8, fig. 9, char. 1, 2, 3, 4] Wherefore because this bone is made vnequall, with many processes both within and without, it was called by the Ancients *πολυμορφον*, *Seare-shape*, according to the Lincolnshire Dialect.

The substance thereof is in the Basis dense and fast, partly because the head lyeth vpon a basis, and therefore the Barbarians call it *os basilare*, partly that it should not be hurt by the excrements that fall downe. In young bodies it is solid, but in growne hollow in the midst, for the hollownesse is made of the solid matter distended; for as he that out of a little quantity of glasse bloweth a great Violl, so Nature according to the vse she had of this bone, first made it dense and solid in children, and then dilated that density into a hollownesse, which is large and couered with a hard and fast scale or shell not at all perforated; as for the inner part, there the substance is not so solid but somewhat spongie.

His substance.

It hath many processes, some externall, some internall; within two on either side, which they call *κλινωδεις*, because they expresse or resemble the lower part of a bed or a Table. [table 9, fi. 10, aa] The two forward of these are the larger & thicker, and from a broad basis do end in a sharpe Cone. The two Posterior in some bodies doe not bunch out at all, but are euen like a Wall, and therefore some haue taken it for one Processe. Their vse is, that the *Dura Meninx* might be more strongly fastened vnto the Skull.

His processes.

The outward processes are double: before, one on either side neere the partition of the Bones of the Nostrils and the Palat, in that place where it is ioyned with the vpper Iaw. And these processes are likened by Anatomists to Bats wings, and therefore called *μεγασδεις*, for they are thicke and yet end into a notable thinnesse, almost as sharpe as the edge of a Knife. [tab. 8, fig. 9, char. 1, 2, 3, 4. tab. 10, fig. 12 HH] They serue for a seate and a couering to the muscles that lurke within the mouth: wherefore in the midst of them there is a deepe and long cavity from which the muscle taketh his originall, and whereby it is defended. On the backside, the bone hath two small points bearing outward the *Styloides*. The anterior of these is blunt, and from it the first muscle of the Chops doth arise; the poste-

rior

His bosses.

sterior is rough and sharp, from whence issueth the five paire of muscles of the lower iaw or very neare vnto it. Finally, there issueth another processe from the middle edge thereof which diuideth the pallat into two. There are also bosses or cavities insculped in this bone. On the outside of the *wingy* processes as hath bin said: on the inside one *anterior* and vpper, which is transverse and long [tab. 9 fig. 10 at C] and prepareth a place for the coniunction of the Opticke nerues. Another *posterior* and lower, almost foure-square, broad, and smooth, very like vnto a saddle. Hitherto the necke of the *Tunnell* reacheth, and in it the glandule which receiueth the phlegme, hath his abode, [tab. 9 fig. 10 E] out of which the same moysture floweth after ward into the pallat and the nostrils: for from this cavity or bossome, at the sides on either hand doe issue two canales very shallow.

The vpper of these [t. 9 f. 10 F] doth attaine forward to his second perforation, through which perforation the teares distill into the eyes, and the phlegme runneth either vnto the Nose or vnto the Chops, through the fourth perforation; through the lower [tab. 9 fig. 10 O] the phlegme is thought to distill into the chinke [tab. 8 fig. 9 N] which is seated betwixt the stony bone, the bones of the *Synsippiut*, and the wedgebone, and from thence into the Pallat.

His Cavities.

Cavities it hath, two at the sides of the forenamed bosses, common with it to the Temple-bones and the bones of the *Synsippiut*; on the inside concavous or hollow, on the outside conuex or embowed. [tab. 9 fig. 10 SS] One also, and that notable, is in the *Basis* of this bone [tab. 9 fig. 10 vnder E] betwixt the surface which is toward the Braine, and that which is toward the cavity of the mouth. This cavity in children, is not found although the part be spongy for a whole yeare, in growne bodies it is hollow and scaley, sometime

See this description, tab. 4. lib. 7.

not distinguished, but spongy and made of diuers scales, sometime it is divided into two distinct [tab. 10 fig. 12 E] cavities [ta. 10 fi. 12 CD] which are great or little, according to the increment or growth of the Bones. This Cavity is covered with a fine and thinne membrane, as those cavities are which be in the forehead and in the cheekes. It is either empty (and therefore some haue thought it was made for the voyce, and that the bones might be the lighter) or in it is contained a viscid or tough phlegme. Vnder these is another small Cavity fundred into twaine by a partition: [table 10 figure 12 O] and from the former Cavity runne two holes vnto the nostrils, [figure 12 F] haply to giue entrance or entertainment to ayre, although *Platerus* saith, it containeth a medullous substance therein. It is couered on euery side with one continued scale, no where bored, or hauing issue but in the capacity of the nostrils: yet is this scale very thinne, and may easily be bored through with a sharpe pointed Probe. If in some bodies these cavities doe not appeare, then it is made within spongy or hollow like a Pumy Stone, ouer the surface of which porous substance are drawne continued scales.

His perforations.

5 in the orbe
of the eye.

It hath ten perforations, some in the orbe of the eye, others in the *basis* of the Scull. In the orbe of the eye five, three proper and two common with the vpper iaw. The first of these neere the processes

TABVLA IX.



FIG. XI.



which

which make the saddle, is circular or round [tab. 8 fig. 8 EE tab. 9 fig. 10 B] made for the transmission of the Optick Nerues, and above in the outside it hath (as it were) a little angle [ta. 9 f. 10 C] through which passeth one small veine vnto the eye. The second perforation bored in the vpper part, is not round, but like a semi-circular cavity, a slit or a long cleft ending into an acute angle, [ta. 8 fig. 8 G, ta. 9 fig. 10 G] but the lower part of it is somewhat long and orbicular. And of this perforation *Bauhine* vnderstandeth that of *Galen*, where he saith; That the wedge-bone is perforated like a Siue, as if his meaning were that this rift is like a Siue, through which the Phlegme doth distill; and fitter it was saith *Galen*, in the 11 *De vsu partium*, that it should transcolate or distill then fall directly through: Otherwise we should be continually spitting, and must haue held our mouthes open; and therefore herein *Vesalins* and *Columbus* were too apprehensue to find fault with *Galen*, whereas indeed they are rather to be found fault withall themselves, that they did not sufficiently vnderstand him, as we could make it manifest, if it were a fit place to dispute so nice questions in, but we follow our History.

Through this second hole passeth the second Coniugation of Nerues vnto the muscles of the eyes which arise thereabout: also, the third paire or the lesser part of the third coniugation which goeth vnto the skin of the forehead, to the muscles of the cheeks, and of the nostrils; which issueth partly by the hole of the fore-head Bone above the inner angle of the eye, partly through the fourth hole; thirdly, a notable branch of the sleepey Artery; fourthly, a veine entreteth into the cavity of the forehead, from the greater veine of the temples; fiftly thereby issue the watery humidities of the Braine, which are gathered together in the glandule, of which teares are made, and those get out of the cavity of the eye, from thence through the fourth perforation into the fist, and from the fist they fall into the cavity of the nosethrils. And these are the vses of the second perforation. The third is immediately vnder the forenamed rift. A little perforation it is and perfectly round, thorough which the lesser branch of the fist coniugation of sinewes is transmitted to the temporall muscle and to those that lurke within the mouth: sometime also it giueth way to the

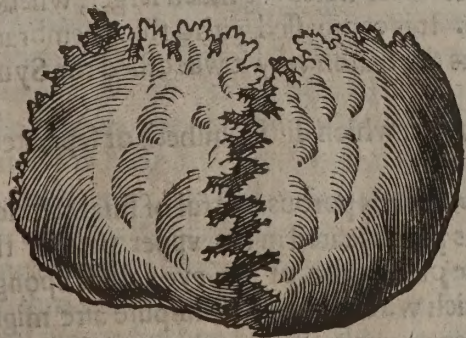
TABVLA X.

See this Table with his description in fol. 443.

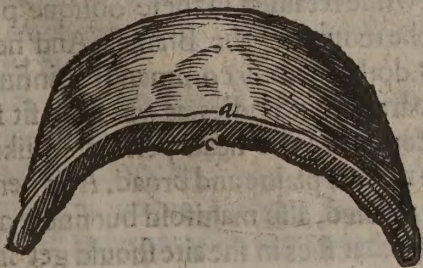
FIG XII



XIII



XIV.



XV.

lesser roote of the third coniugation, which falleth out sometime together with the second paire. [tab. 8 fig. 8 H ta. 9 f. 10 H] The fourth perforation in the outside of the cavity of the eye towards the nose is long and large like a rift, and is common to the wedgbone with the fourth bone of the vpper law. It transmitteth out of the orbe of the eye small nerues of the lesser root of the third and fist coniugations, and phlegme or rheume with them, all which entred into the orbe by the second hole. [t. 8 f. 8 & 9 D] The fist hole lurketh in the root of the eye at the end of the fourth. It is a long, large and notable perforation, through which the rheume which fell out of the Scull through the second hole, and into the orbe of the eye by the fourth hole, is conueyed vnto the capacity of the nosethrils, [t. 7 f. 7 *] and these are the five perforations of the wedge-bone in the orbe of the eye.

In the basis also of the Scull it hath five perforations. The first within, at the side of the bosome where the Glandule is seated: a wide, short and orbicular hole it is which admitteth the great branch of the sleepey artery to the second hole of the templebone into the Scull. [tab. 9 fig. 10 X] The second is on the outside, somewhat long and large, which transmitteth the greater roots of the third and fourth coniugations of sinewes,

O 6 0 0 3

com:

Galen redeemed.

out of the basis of the Scull.

commonly so called. [tab. 8, fig. 9, Q, ta. 9, fig. 10 Q] The third adioyneth on the outside to the second, but is much lesse and round, made to admit the branch of the internall Iugular veine which entreth into the scull and into the substance of the *Dura meninx*; [ta. 8, fig. 4 R, tab. 9, fig. 10 R] sometime at the side of the sixth perforation we find small holes prepared to admit a branch of the foresaid Veine. [tab. 9, fig. 10 M] The fourth is at the Nostrils, a long hole and running directly outward, through which a branch is conveyed into the cavity of the nostrils [tab. 9, fig. 10 V] from the greater branch of the sleepe artery. The fifth and last perforation of the wedge-bone is in the palate at the extremity of the winged proesse: it is large and almost oval, that through it the third coniugation of sinewes and the fourth might issue: [ta. 8, fig. 9, u] The third into the tongue and his coate, to the teeth and the lips to giue them sense; the fourth to make the coate of the pallet. And thus much concerning the wedge-bone

Of the Spongy Bone.

The second Bone that is common to the Head and the Iaw, which *Vesalius* and *Columbus* make the eight bone of the head, Anatomists haue called *Ethmoides* or the *Syue*, not because it is full of holes and dennes, but because these holes are not direct (though some direct there be) but curved or writhen as are the holes of a Sponge. It is more truly called *Spongoides* or the Spongy-bone, which name *Hippocrates* gaue it, as *Galen* witnesseth in the 7 chap. of his 8 Booke *De usu part.*

Situation,

It is situated in the forepart of the scull before the *Meninges* and filleth vp almost the whole cavity of the Nostrils. It is ioyned to the middest of the forehead bone, [tab. 9, fig. 10, R] and is distinguished on the backside from the wedge-bone by the ninth future of the head, if that be not rather a harmony or Ccementation then a future; [ta. 9, fig. 10 above u] on the outside it determineth at the second bone of the vpper iaw, *Columbus* saith at the second and the third.

Figure,

The figure of it is like to that square that on one side is longer, on the other broader: but he that would see the true figure of the bone must take viewe of it in a child but of one year old, for afterward it cannot be seuered from the rest of the bones without breaking. At that age also a man may perceine how that which is accounted by *Vesalius* and *Archangelus* the third bone of the Iaw which maketh the thin but solid and plaine part of the orbe of the eye, and the Spongy bone of the nostrils which is oft eaten out by the French disease, and the Syue-bone, are all parts of one and the same bone. For, indeed there are foure parts of this bone.

Parts,

The first is the vpper proesse in the middle of the bone, long and triangular, ending in a sharpe point and resembling a Cockes-combe; sometimes it is thin and broad; sometime thicke and diuideth the whole bone like a partition: it distinguished also the Mammillary processes of the Braine. To this part also the third sinus of the *Dura meninx* which diuideth the Braine groweth very strongly. [ta. 9, fig. 10 * ta. 10. f. 12 B]

The second part of the Spongy-bone is on either side at the proesse where it maketh the cavity of the scull. It is throughout perforated like a Syue with abundant, small and oblique holes. [tab. 9, fig. 10, KI tab. 10, fig. 12, AA] In dogges these holes are much larger, whence haply it is that their smell is so briske and sharpe. It is compassed with a thin Membrane which is perforated like the bone, and that indeed was the reason why it was called the Syue-bone or the Collander.

The third part is a lower proesse opposite to the vpper which distinguisheth or separateth the vpper part of the nostrils.

The fourth part and the last like a sponge or a pumi stone is porous and full of smal cavities, whereupon the whole Bone is called *spongoides*. This part is seated in the vpper part of the nostrils, and accomplisheth or perfecteth the inside of the orbe of the eye. It is spongy and full of oblique perforations that the cold aire which we breathe in, or impure aire might not insinuate it selfe directly into the Braine vnbroken or vnaltred, whereby it might be too much refrigerated or otherwayes annoyed; for being a while retained in these oblique passages it receiues a mutation, and is made more like to the temper of the Braine. And here *Galen* in the seuenth chap. of his eight Booke *de usu part.* doth worthily commend the infinite wisdom of our creator, who hath disposed of all the parts of our bodies, as was most fit for our vse and preservation. This bone therefore is manifold: at the head perforated like a Syue, at the cavity of the nostrils spongy, at the orbe of the eye plaine and broad. And hence it appeareth that the substance of this bone is very thin thrilled, also manifold but finely and oblique, finely or with a small bore least any thicke body that flies in the aire should get into the braine.

The wisdom
of God well
obserued by
Galen.

The

The vse of the perforations is, saith *Galen* in the sixt Chap. of his 8. booke *de usu partium*, The vse of the perforations, that through them the ayre might be breathed in for the generation of Animall spirits: againe, that with the aire odours or sauiours might ascend into the braine, and therefore the Mammillary processses or the organs of Smelling doe run out hard vnto these perforations; hence it is that those that be troubled with the *Coriza* (we call it commonly the *Pose*) cannot smell, because these perforations are stopped vp with Rheume. There is also good vse of them in diseases of the braine, that the ayre being altered by medicines, and retained longer in these caviities, might worke more powerfully vpon the braine.

Galen in the place last before quoted addeth another vse. By these perforations saith he, when neede is, abundance of excrements may be suddenly and togetherward auoyded: so likewise saith *Laurentius*, but maketh it a secondary vse, yet *Platerus* denyeth that there can be any such confluence, vlesse it be vnnaturall or beside nature.

Finally, in the backside of this bone on either hand there is a semicircular rift or cleft, as if it were pinched with a mans nayles, which establieth [tab. 9, fig. 10, below K] the *Dura meninx* fastned thereto and perforated with diuers holes. And thus much concerning the spongy bone which is the last of the bones of the head or of the Skull. Now we proceede vnto the bones of the Nose.

CHAP. VIII.

Of the Bones of the Nose and of the Yoake bone.



HE Bones which make the cavity of the Nostrills are of two sorts: some which may be said to be proper to the Nose although indeed they be bones of the vpper iaw, others are common. The proper bones are three, two externall and the third internall, and these runne onely vnto the middle of the Nose, for the rest is altogether gristly.

The two externall bones which make the arising bony part of the Nose are one on each side, small and quadrangular, but one side is longer then another. These are thin but very solid, perforated with small and common holes and are portions of the fift bone of the vpper iaw, [tab. 8, fig. 8, =] which portion aboue is ioyned in a short cut by the third common suture with the forehead bone betwixt the browes. [ta. 8, fi. 8, z 7] At the sides they are vnited by a proper suture, *Archangelus* calleth it a *Harmony*, running along the side of the Nose [ta. 8, fi. 8, from e towards y] with the 4 bone of the iaw [ta. 8, fi. 8, B fi. 9, s A] which maketh the sides of the nostrills, the lower part of their holes, and the greatest part indeed of their capacity. Below they are vnited by gristles, wherefore at their end they are rough vnequall that the gristles and the bones might cleaue faster together. On the inside they are ioyned by another common line and cleaue fast vnto the partition of the *Syue-bone*.

The two externall Bones.

The third bone we said was inward within the cavity of the nostrills: broad it is and thin at the roote, but before and aboue thicke: it tendeth vpward to the holes of smelling and downward to the Pallat. This is placed betweene the two former and adhereth, yea is vnited to a processe of the *Syue-bone* or the eight bone of the head. [ta. 9, fi. 10, vnder x] It is called *Septum* or the partition, because it distinguisheth the cavity of the nostrills into two parts. [tab. 8, fig. 8 O] It is ioyned to the two former or the fift bone of the iaw by the first internall suture. [ta. 8, fi. 8, vnder f] On the foreside it determineth into the middle gristle wherewith it is vnited. At the inner hollownesse of the Nose toward the Pallat where this bone is seuered from the wedge-bone, it is deuided throughout his length by a broad rift, passeth throughout the Nose, and having his *Basis* which is thicke and broad bifurcated it lyeth vpon the wedge-bone, resembleth the share of a Plough [ta. 8, fi. 9, c] and his edge is sinuated or vnequall. Finally, it is ioyned on the inside to the fourth and the sixt bones of the iaw by the second internall suture. [tab. 8, fig. 8, g] These are those three we call the proper bones of the Nose.

The third internall.

The common bones are, first that which we called the spongy bone which cleaueth to the top of the roote of the Nose, for in the inside of the Nose at this bone there are found two fungous and spongy portions which fill the vpper cavity of the nostrills, and are made to assist the voyce and the smelling. Their forme is very diuers, but they seeme to be most like scales growing one vpon another. They are vnited with the *Syue-bone*, from

The common Bones.

whose

whose outward sides they issue, so that saith *Baubine* for my part I beleue that they arise from it and are parts thereof, although they do not grow to the partition. Again they are vnited a good way in their sides to the forehead bone: on the inside they are so conioyned with the third bone of the iaw, that *Falopius* hath referred this third bone of the iaw to the addiments of the Syue-bone and that not without good reason. In these the ayre which is drawne in together with odours receiues an alteration. They are vnequall and rough, that the excrement of the Nose should not perpetually distill downe, and in the French disease they are easily gnawne asunder.

Below at the pallat, the fourth bone of the iaw [tab. 7, fig. 9, A] and the sixt [tab. 8, fig. 9, II] together with his fellow do make the greatest part of the capacity of the nostrils where they open backward into the Chops.

A briebe of
the bones of
the Nose.

In a word, this whole bony cavity of the nostrils is formed of bones both on the inside and on the outside. Without, either before or at the sides, outwardly and before, aboue by the fourth [tab. 8, fig. 8 B] and fift [≡] bones of the vpper iaw to which gristles are adioyned. Below at the pallat, by the fift [tab. 8, fig. 9, A] and the sixt. [II] On the inside by the spongy bone of the head, [tab. 9, fig. 10, K] by the two spongy bones of the nostrils, and by the partition of the nostrils: [O] at the sides the cavity is made vp by the second, [tab. 8, fig. 8, Δ] the third [○] and the fourth [from X to B] bones of the vpper iaw.

Of the Yoake-bone.

The yoake-
bone.

The Yoake-bone [tab. 7, fig. 6, X] is called *ζυγωμα*, because it is made of two bones ioyned together. It is seated in the sides of the face vnder the orbe of the eye. This is no peculiar bone though it haue a peculiar name, but is compounded of two processe of two seuerall bones: one of the Temple bone another of the first bone of the vpper iaw, which two processe are in the middest ioyned together by an oblique suture [tab. 7, fig. 6 Y tab. 8, fig. 8 P] and so make one bone like a yoke, although me thinks it is better compared to a bridge. On the outside it is gibbous, within hollow. The roots on either side are thicke, But the middle of the processe which issueth out of the Temple-bone is but slender.

His substance.

The substance of it is hard and almost solid, almost lsay, for it hath a cavity in it, such as it is, wherein it containeth marrow for his nourishment, yet is it somewhat solid too, the better to defend the Temporall muscle, especially his Tendon (before which it is placed) from outward iniuries: beside the muscle called *mansorius* taketh his originall therefrom, and againe it strengthneth the Scull which is there but thin. And finally saith *Platerus* and with him *Laurentius*, it giueth a great strength vnto the orb of the eye which swelleth out a little aboue it. And so much of the yoake-bone: now we proceed vnto the vpper iaw.

CHAP. IX.

Of the Sutures and Seames of the upper iaw.



THE iaw is called by *Aristotle* *σινγών*, because when we hold our Iaws together we keepe silence, which the Grecians call *σινγών*; it is also called *γένυς*, because there the beard doth first flourish or breake out. The iaw is double, the vpper and the lower, called by *Hippocrates* and *Galen* *άνω*, and *κάτω γένυς*.

The diuision
of the face.

The vpper iaw is the bony part of the Face, which maketh the lower part of the orbe of the Eye and the sides, the cavity of the Nostrils, the Cheeks, the Pallat, and containeth the vpper rowes of the Teeth.

This vpper iaw is to be considered either whole or according to his parts of which he is compounded. In the whole iaw we consider his conformation and his connexion which is made by sutures. In the consideration of the parts we will examine the bones whereof it is compounded.

The protuber-
rations of the
vpper iaw.

The conformation of the whole iaw is diuers, broad aboue and narrow below, because of the protuberations, perforations and cavities which are therein. The prominences or protuberations are aboue in the middle of the face where the nose is formed, [ta. 8, fig. 8 f] which is peculiar only to man, for onely a mans Nose swelleth out or standeth off from his Face. At the sides it swelleth on both hands, at the Temples to make the lower edge or verge of the Eyes and of the Cheekes [ta. 8, fig. 8 aboue r] although it also make the lower cavity of the eyes.

yes. Below on the outside, where the roots of the teeth are it buncheth circularly: [under A] within it maketh the anterior and greater part of the pallat which is rough, [ta. 8 fig. 9, 17] and in the circumference it protuberateth for the dens or sockets of the teeth. [fig. 9 iii]

The perforations.

The perforations are partly small, through which the veines, arteries, and nerves are transmitted, as shall be said in the History of the particular Bones: partly great, two in the lower cavity of the eyes, as in the second bone [fig. 8. C] through which the rheume falleth and a small Nerue vnto the nostrils; and in the fourth through which a little nerue runneth to the outside of the cheekes. So also in the foreside of the Palate and in the middest thereof one perforation which admitteth a small veine and a little Artery [fig. 9, 2] and on the backside of the palate two on either hand which run vnto the sides of the nostrils. [at V]

The cavities.

The Cavities are Proper and Common. Proper to the fourth bone wherein there is a den closed vp within the bone at the sides of the nostrils [fig. 8, vnder BV] and the sockets made to receiue the teeth, of which we shall speake in the descriptions of the fourth bone. The Common cavity is that of the nostrils, distinguished by the partition and filled about with the spongy bones, which cavity both outwardly in the nose [fig. 8 00] and inwardly in the mouth [fig. 9, at qq] is alwaies open, that the ayre in expiration may retorne backward, and in smelling be drawne vpward, and Rheume be that way euacuated.

This vpper iaw in all creatures is immoueable excepting the water Crocodile, of which saith *Archangelus*, there can be no particular reason giuen. A common Reason he giueth out of *Aristotle* where he saith, that the Body is the Instrument of the Soule, and therefore Nature hath accommodated the Body and so furnished it (as we see) for the behoofe of the Soule in Men, in Oxen, Horses, yea and in the Crocodile too, whose soule hath some power or faculty to vs vnknown, but expressed by the motion of the vpper iaw; but his neather iaw is so vnted with the Temple-bones that it cannot at all be moued, because it is fastned into 2 bosomes, whereas the vpper is articulated on either side with a broad head. Yet *Aristotle* saith, that his vpper iaw was made moueable to recompence the defect of his feete, because they are little, and vnfit either to catch or to retaine his prey.

Why the Crocodiles vpper iaw is immoueable.

In a Parrot or Poppingey both iaws are moueable, and he moueth them either one at once or both together as he listeth. In a man the vpper iaw is immoueable, first, because the motion thereof would haue hindred his sight. Againe, in receiuing of Odours and inspiration of aire the motion of the vpper iaw would haue made an interruption. Thirdly, hard meats could not haue bene so well broken; for as in a Mill where Corne is ground one stone must rest immoueable the other must run vpon it, so in the grinding or breaking of meate it was necessary that one part which is the vpper iaw should be immoueable, the other which is the lower iaw moueable.

Why a mans iaw is immoueable.

Heereto we may adde, that the immobility of the vpper iaw is a beauty to the face, for if it had bene moued then it must necessarily haue bene corrugated or contracted, and so the elegancy and forme of the face bene deformed, whereas in the frame of mans body our Wise Creator had an especiall respect to make the face beautifull, because it is the image of the soule; wherefore a mans face is not set off from his head as in brute beasts, but made short and round for beauty and better forme.

The vpper iaw is fastned either with the bones that are about it, or with the proper bones of which it is compounded; which connexion is made by immoueable commisure or coniunction, and that partly by sutures or seames, partly by *Harmony* or *Cementation*. Of these Sutures or commisures some are common vnto the skull with the bones of the vpper iaw, and those are five, of which we spake before in the fift chapt. Others are proper to the bones of the iaw and are nine in number, and ioyne together twelue bones of the iaw; some of these, that is, two, are in the cavity of the nostrils, the other seuen are on the outside. Againe of these seuen five are common to two bones of the iaw ioyning together, and two are peculiar to one bone. Of these in order.

Connexion.

The first internall suture we meeete withall in the cavity of the nostrils, and it is common to the partition and the fift bone. His course is short and obliquely downward. [table 8, fig. 8, vnder f] The second is also found thereabout and is common to the partition of the nostrils and the fourth and sixt bones of the iaw, his course is somewhat longer and forward, but ouerthwart [tab. 8, fig. 8 g].

The first internall suture.

The first externall suture runneth obliquely to the cheek-bone, and of it there are three parts, the first runneth through the cavities of the Temple-bones outward and downward to the lower side of the cheek: the second through the foreside of the cheek vpward and inward

The first externall.

inward to the middle part of the eye. [tab. 8, fig. 8 from *a* unto the lower *D*] The third in the cavity of the eye; it runneth backward and outward [From the lower *D* to *Q*] and determineth at the second suture which is common also to the scull. This first externall suture is common to the first bone and the fourth.

The second externall suture runneth circularly in the orbe of the eye about the compasse of his bone; it beginneth at the third common suture and runneth downward, then presently forward, and againe from thence vpperward. This suture is common to the second bone with the third on the backside, and to the fourth bone on the outward and lower side. [tab. 8, fig. 8 from *V* to *i*. from thence to *C* and *Δ*]

The third is also in the orbe of the eye, and runneth directly outward from that suture which is called the second common suture of the wedgebone, and determineth in the second suture; it is common to the third and fourth bone. [tab. 6, fig. 8 from *d* to *c*]

The fourth is at the outside of the nostrils, and runneth from the third common suture directly downward throughout the length of the fift bone as far as to the gristle, and this is common to the fourth bone and the fift. [tab. 8, fig. 8 from *z* to *e*]

The fift is in the pallat and runneth ouerthwart through the backside thereof, and it is common to the fourth bone with the sixt. [tab. 8, fig. 9, *t u*]

The sixt is in the vpper part of the nose, and runneth from the middle of the Browes, where the third common suture is, directly throughout the length of the nose, and distinguisheth the fift bone through the middest.

The seventh is in the pallat, a line rather then a suture: so also is the sixt saith *Columbus*, it runneth directly through the whole length of the Pallat, and is very conspicuous both within and without the Nostrils, and diuideth thorough the middest the fourth bone and the sixt. [table 8, fig. 9, *y e*] So also in the forepart of the iaw it runneth from the cavity through the middest of the shearing-teeth directly downeward vnto the pallat, [table 8, figure 8, *b*] but in Dogges, Apes, and Swine, and those creatures whose Dog-teeth are strong and hand ouer the iaw, we meete, saith *Vesalius*, with two sutures or Harmonies which are not to be found in a man, and therefore they haue peculiar bones in which the Shearing-teeth are fastned.

The bastard
Sutures.

There are also certaine Bastard Sutures which do not quite diuide the Bone but are rather lines or inscriptions and are onely found in the fourth bone: first in the lower part of the orbe of the eye which runneth from the first perforation obliquely vnto the compasse of the eye but no further, and diuideth the fourth bone betwene the vpper seate of the first perforation and the circumference of the eye. [table 8, figure 8, *i*] Again, in the forepart of the palat runneth a line obliquely from the second perforation of the fourth bone vnto the Dog-teeth.

Disagreement
betwixt *Falopius*
and *Col.*

This saith *Columbus* in children is very manifest, but in growne bodies there remaineth no signe or footstep thereof. Heereto opposeth *Falopius* in his Observations where he saith, I dissent from them who say there is a suture found attaining ouerthwart vnder the pallat to the Dog-teeth on either side, which in children should be conspicuous, but in growne bodies is obliterated. For I finde, saith he, that this is a diuision or a rift rather then a suture, because it doth not separate one bone from another nor appeare on the outside: for how can it be a kind of articulation if it do not ioyne one bone with another. Moreover, I cannot be perswaded that this diuision, such as it is, is more conspicuous in children then in growne bodies, for I finde it very seldome obliterated and that in very old men. Thus farre *Falopius* & *Baubine* addeth, that although in men it doe not diuide the Bone throughout, yet in Dogs, Apes and Hogs it doth, in which creatures it doth not onely diuide the fourth bone in the pallat, but also on the outside in the forepart of the iaw.

CHAP. X.

Of the Bones of the vpper Iaw.



THE vpper iaw doth not consist of one Bone but of many, not onely to make it fitter to repell iniuries, but also and especially that out of their Commissures and coniunctions might issue Ligaments to make vp the construction or frame of the Muscles, which by that meanes are more firmly fastned to their originals as to bony

bony parts and thereby made the stronger. Beside, it was not fit that the vpper Iaw should be on euery side a like thicke or hard, or fast or soft. The bones therefore of the vpper iaw are of two sorts. Common and Proper.

The Common Bones are the Wedge and Spongy bones called also the seauenth and the eight bones of the head. From this eight bone doe yssue two spongy Bones seated in the inside of the nose, which distinguish the vpper part into two sides, to these are ioyned other two which make vp the inner orbe of the eye, which also we will account, as other men doe, for the third bone of the Iaw. But of these wee haue partly spoken before in the seauenth chapter among the bones of the Head, partly in the eight amongst the bones of the Nose, and therefore we will come now vnto the proper bones of the Iaw.

The common
Bones of the
Iaw.

The proper bones of the iaw which helpe to make the face are twelue. The first [ta. 8, fig. 8, r] maketh a good part of the Cheeke, the lower part of the eye towards the Temples, that round extuberation which Hippocrates caeth *κυκλον προσωπου*, the circle of the countenance, one part of the yoke-bone, a little of the temples and the vtter angle of the eye. The figure of it saith Columbus is diuers: Bauhine saith it is triangular, sending fourth of a broad middle, thre protuberations; one to the angle of the eye, another to the teeth, and a third which is most notable, that is, the proesse which maketh a part of the yoke-bone, [ta. 8, fig. 9, r with r] and hauing a perforation or two but very small ones.

The proper
Bones: first.

This first bone is ioyned to foure bones: aboue, to the forehead bone where the eye-browes end by the first [ta. 7, fi. 6, and 7 g] common suture: [ta. 8, fi. 8 R] behind, to the wedge-bone by the second common suture: [ta. 8, fig. 8, from S to Q] at the sides, it is ioyned by his proesse to the proesse of the Temple bones by the fourth common Oblique suture: [ta. 8, fig. 8 P] below, to the fourth Bone of the vpper iaw neere the cheeke, and in the lower part of the orbe of the eye. [tab. 8, fig. 8 from the lower D by the vpper D vnto Q]

The second bone [tab. 8, fig. 8, A] standeth in the great angle of the eye neere the Nose, and iust at the beginning of the angle where the holes goe into the nostrils [ta. 8, fig. 8, C] wee meete also with a caruncle which like a glandule receiue the Phlegme which floweth from the Braine vnto the eye to deriue it vnto the nostrils that it should not fall downe the cheekes. Galen also addeth, that Medicines which are put into the eyes, do vse to issue out of the nostrils, whereat Columbus much marvelled, because such medicines must penetrate the Membrane before they can get into the nose.

Second.

This is a small bone, thin as a scale and transparant, and because it hangeth but loosely, as being rather ioyned by harmony then by suture to the outside of the fourth bone, it is easily broken and lost, and therefore we rarely meete with it in the skulls digged out of the earth, for being in a moist place it easily putrifieth; but in those skulls that are boiled it is easily preserved. It is ioyned to three bones: aboue, to the forehead bone by the third common suture: [ta. 8, fi. 8, neere V] behind, to the third bone of the iaw by the second external suture; [from V to V] before & below to the fourth of the iaw by the same suture; [from C toward X] sometimes also it is ioyned vnto the spongy-bones of the Nose. And this is the place where those Apostemations are which the Græcians call *αἱματωπας*, which if they be neglected doe penetrate to the mouth, and do end into weeping *Fistulaes*. This bone also hath some perforations; aboue some small ones which are common, one also very notable which is common to it with the fourth bone. [tab. 8, fig. 8, C] which runneth out of the inner angle of the eye directly downward into the cavity of the Nostrils; the vse of it is to transmit a small portion of the lesser roote, commonly so called, of the third coniugation, and also Rheume or Phlegme.

Aegilops

Weeping Fi-
stulaes.

The third Bone which we said was the fourth part of the Spongy-bone, [tab. 8, fig. 8, B] but is by most made the third of the vpper iaw, is seated in the inner side of the eye, and within is continuall with the fungous bones of the Nostrils. This is broader then the second quadrangular but somewhat round, thin and transparant like the scale of a fish; without smooth, within rugged and vnequall, because of the scales that cleave vnto it: and if you breake it, within you shall finde large cavities filled with ayre.

Third.

It is ioyned to foure bones. Aboue to the forehead bone by the third common suture, and there is a good length off the suture betweene them. [table 8, fig. 8 from T toward S] Behind, to the wedge-bone by the same suture, but the length of it is lesser. Before, with the second Bone of the iaw by the second suture. [from V to C] Below, to the fourth bone of the iaw by the third suture. [from C to b]

The fourth bone [tab. 8, fig. 6, A A] maketh for the most part the forepart of the nostrils and

The fourth.

and of the mouth, into which all the vpper Teeth are infixed, also the sides and lower part of the pallat and of the holes of the nostrils: yea and beside the lower part of the orbe of the eye toward the Nose. *Galen* calleth it *Os male* the Cheek-bone, and he saith it deserveth well to be called by the name of the whole, the vpper Jaw. It is much larger then any other of the bones, and is circumscribed with many sutures, for it abuteth vpon seuentene bones if you reckon the Teeth. Aboue neare the Nose it is ioyned to the forehead bone (yet but a little way) by the third common future. [*tab. 8, fig. 8, X R*] Below to the wedge bone by the second common future [*ta. 8, fig. 8, from D to H fig. 9, from d to e*] where also the vpper part of the wedge-bone and the iaw do yawne into the orbe of the Eye.

His connexions.

It is also ioyned with other bones of the vpper iaw: as to the first by the first oblique future [*tab. 7, fig. 6, ab Q*] in the Cheeke, the orbe of the Eye and the cauities of the Temples. Before to the second in the inner angle of the eye by the second future. [*ta. 8, fig. 8, from C toward X*] Behinde to the third by the third future. [*from b to c*] On the outside to the fifth bone in the top of the Nose by the fourth future: [*e r*] to the sixth in the Pallat by the fifth future: [*ta. 8, fig. 9, tu*] and finally to his owne companion by the seventh future, or rather by a line, partly in the forepart of the iaw [*tab. 8, fig. 8, b*] where the furrow is of the vpper Lip, partly in the pallat. [*ta. 8, fig. 9, x y*] Into this fourth bone also are the vpper Teeth fastened by *Gomphosis* or way of *Mortize*, and finally it is vnited vnto the Gristles of the Nose.

Perforations.

It hath also perforations and dens. The perforations are Common and Proper: one Common which is very small toward the inner angle of the Eye. The proper are 3. two in the lower part of the Eye, on each side one, which is onely couered with a bony scale, and runneth from the lower part of the Eye outward: his vse is to transmit a surcle of the lesser roote, commonly so called, of the third coniugation of sinewes out of the orbe of the eye into the Face. [*tab. 8, fig. 8, at b*]

The third hole is in the Pallat at the backpart of the *Shearing* or shredding Teeth, where both bones of the iaw do meete. [*tab. 8, fig. 9, z*] It runneth out of the Pallat into the capacity of the Nostrils, and transmitteth a small veine and a small artery vnto the nose; and at the sides hereof there appeareth a future in young children.

Cavity.

The dens or cauities of this fourth bone are of two sorts: of the first is one on each side at the lower sides of the cavity of the nostrils vnder the orbe of the Eye. It is a great cavity, and so large sometimes that in it a man may lay his thumbs end: and therefore it may well be likened to those hollow images made of molten waxe; yet it is couered with an attenuated bone, blowne vp as it were round, [*tab. 8, fig. 8, vnder B A*] which was made partly because of the lenity of the bones, which in this place stood in neede to be thicke by reason of the situation of the eyes, partly because it is most fit to forme the voyce, so saith *Vesalius*.

This cavity is not to be found in young children, but is made as they grow, and is inuested with a very fine coate, it is also found full of mucous or slimy phlegme, or marrow saith *Archangelus*, whereby the bones that containe the Teeth and all the vpper Teeth also are nourished. Of the second kinde of dens of this fourth bone, are the sockets or mortizes of the Teeth which are insculped in the lower brinke thereof, in which the teeth are fastned. [*tab. 8, fig. 8, vnder b.*]

The fifth.

The fifth bone of the vpper iaw, [*ta. 8, fig. 8, z z*] which with his companion maketh the bony prominence of the Nose, is a small bone and almost quadrangular, but somewhat long, yet shorter by farre in a man then either in Dogges or in Apes. It is a hard, solid, broad and thin bone having small common perforations in it. It is ioyned aboue to the forehead bone by the third common future: [*tab. 8, fig. 8, y z*] againe in the sides to the first bone of the iaw on either hand, and outward to the fourth bone by the third proper future, [*fig. 8, from c to r*] and in the middle it is ioyned to his companion by the sixth future [*fig. 8, from z to f*] which is not much vnlike a harmony, and runneth directly from the future of the forehead throughout the length of the bones of the Nose. Below it hath no future but is rough and vnequall that the gristles of the Nose might take better hold vpon it. On the inside where these two bones are ioyned, they adhere to the bony partition vnder them, and that cleaueth to the spongy bone.

The sixth.

The sixth and last bone of the vpper iaw (for you must reckon every one of these double, one on one side, another on another) [*tab. 8, fig. 9, n*] is placed at the end of the pallat, where the nostrils do determine into the chops and maketh together with his companion the backpart of the circumference of the nostrils and the pallat. It is a broad bone thin and solid, and in the end where it is rough it resembleth a semi-circle. [*tab. 8, fig. 9, aboue q*] It is ioyned

ioyned behinde, to the wedge-bone at his wingy processe: belowe, and on the outside by a part [q] of the second common suture. On the inside to the partition of the nostrils by the second externall suture: [tab. 8, fig. 8 g] againe, to the fourth Bone of the iaw by the first transuerse suture; [fig. 9, f] and finally, to his companion in the backe-part in the pallat by the sixt suture running along the length of the pallat [tab. 8, fig. 9, from t to x]

It hath two perforations on either side, one large which runneth vpward and backward to the ninth common hole of the wedge-bone, [tab. 8, fig. 9, a little below u] the other small, which sometime determineth into the former, sometime into the second common suture. [aboue q at r]

The perforations.

CHAP. XI.

Of the lower Iaw.

The lower Iaw, which the interpreter of *Hallabba* calleth *Faucem* [table, II, figure 1, and 2] maketh the lower part of the capacity of the mouth, into it the Teeth are infixed and it is articulated to the scull. In men it is moueable and by it they chew their meate: for because the Teeth must grind and cut that which is eaten, it was necessary that the vpper Teeth should depart from the lower and returne againe vnto them. And because in the descent it needed no strength, but in the ascent very great strength, as well to lift vp the weight of the Bone as to breake the meate, therefore it is depressed by weake muscles, but lifted vp by exceeding strong, as we haue shewed before in the 10 Booke. This Iaw in a man is shorter then in any other creature proportionably. It is almost orbicular because of the roundnesse of his face wherein is his beauty. In other creatures, saith *Galen* (excepting an Ape, whose face and hands are much like vnto a mans) the Iaws are long and prominent, because they vse them instead of hands, and because they were to be enclined to the earth to gather their food.

The lower Iaw.

The figure of it is like a bow, the belly hollow for lightnesse, and that it might not offend the muscles which moue it. Before, in the top of the chin it is broad and thicke, in other creatures it is narrow and prominent. Behinde it is parted, partly that the passage of the meate should not be hindred, partly that it might more commodiously for motion be articulated to the scull on either side.

His figure.

For it hath on the backside on either hand two processe (some call them Hornes) which run vpward. One turned backward, [ta. II, fi. 1 and 2 C] broad and thin, ending into a cone or point called *κορυμή*, which receiue the tendon of the temporall Muscle; for that tendon compasseth it round about, and is very strongly implanted thereinto; and hence haply it was, that *Hippocrates* saith, the luxation of the lower iaw, is most what mortall, because of the distention and alteration of the temporal muscle. A disease common in the *Bermudas*, of which they dye within 2 or 3 dayes.

Processe.

The other and the backer processe is called *κορυμβότης*, and is like a knot. It runneth backward, hauing a long prominent head and transuerse, [fig. 1, and 2 A] whereunder there is a notable necke. [B] By this head it is articulated into a cavity on either side answerable there-to insculped in the Temple-bone, which articulation is made betwixt the roote of the yoake-bone and the Hole of Hearing. By this articulation the iaw is moued vpward to the scull, downward also and somewhat to the sides: ouer the head, as also ouer the sinus there is a gristle couering them like a crust.

But besides this which is common to all ioynts, there is another gristle reposed betwixt the bosome and the head which is smooth, thin and soft, doing not onely the office of a Ligament to containe the processe within his cavity, but also it maketh the motion of the ioynt more glibbe and slipping. Moreouer, together with the other gristles in the strong and perpetuall motions of the iaw it keepeth the bones from breaking, at least from wearing one against another.

This ioynt also of the lower iaw with the Temple-bones is covered with a common Membranous Ligament. On the backside on either hand where it shooteth out his processe [figure 1 and 2 EE] it is exasperated with small protuberations like little rising hillocks especially where it is broadest behinde and below. Before and on the inside in the middle of the chin there riseth a bunch vp, [figure 2 H] made for the stronger insertion of the pro-

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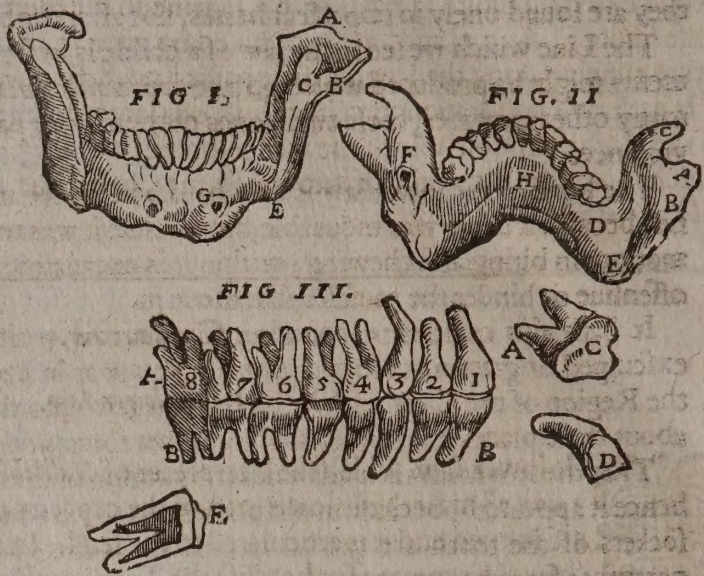
Tab. II. sheweth the lower iaw together with the teeth in the first and second figures. The third figure sheweth the Teeth by themselves.

- A. The head of the iaw where it is articulated vnto the Temple-bones.
- B. The necke of the Head.
- C. The proceſſe into which the Temporall Muscle is inserted.
- D. A Bosome or cavity giuing way to the third muscle of the lower iaw.
- E. A roughnesse into which is inserted the muscle called *Manſorius*.
- F. The inner perforation.
- G. The vtter perforation.
- H. Asperities into which the Muscles are implanted.

Third figure.

- AA. Eight vpper Teeth.
- BB. Eight lower teeth.
- C. The basis or bottom of a grinding-tooth called *Molaris*.
- D. The basis or bottome of a shearing-tooth called *Incisarius*.
- E. The Cavity that is in the grinding teeth when they are broken.

TABVLA XI.



per muscles by which it is led downward, as also to giue a more commodious originall to some muscles of the tongue; for where the place is rough and vnequall there the muscles will cleaue the faster. In like manner also is it exasperated on the outside at the top of the chin; [tab. II, fig. 1 vnder G] that the Muscles of the lower lippe might better arise therefrom.

The bosomes.

At the sides of the processes it hath superficially or shallow bosomes, yet so that it is more hollowed on the inside then on the outside. Without on each side one, and that large; [fig. 1, betwixt BC] within two distinguished by a certaine knot, [fig. 2, neere DB] The anterior at the roots of the teeth was made to giue way to the gummes, the posterior and the larger affordeth a seate vnto the muscle that *lurketh in the mouth*, that his thicknesse and bulke should not fill vp the narrownesse of the chops.

The composition of it.

It is compounded of two bones, for in infants the two bones are very manifest, ioyned together in the middle of the chin by a plentifull gristle, so that in some bodies at seuen yeares of age, the markes or footsteps thereof doe remaine, but in growne bodies the gristle is changed into the nature of a bone, and those two bones are so strictly vnited, that there doth not appeare so much as any shew of a line betwixt them, neither can they be separated by boyling, by putrifaction, or by any strength, which is the reason why *Vesalius* concludeth it to be but one bone. For, saith he, although in young children it be formed of two bones vnited together, yet we cannot simply say that the lower iaw consisteth of two bones, vnlesse we will also say, that the Nowle-bone, the *vertebra* or rack-bones and the bones that are ioyned vnto the sides of the Holy-bone be made of many bones, for in children euen these are built vp of many bones.

Vesalius.

Falopius

Falopius makes answer, if *Vesalius* say we may not make denomination from imperfect partes, then certainly all Anatomistes haue erred who speake so much of Appendances: for they are found onely in imperfect bones, not after the body is growne: but to proceed.

The Line which we see in the iaw of a childe is in stead of a future, that out of it the Ligaments might be produced which go into the muscles of that place. In Dogs, Oxen, Asses, and many other creatures, these two bones may easily be parted without coction or any great violence.

The bone of the lower iaw is very hard, and for the most part solid to make it the stronger; not because it alone was moueable, but because it was to endure diuers and those very violent motions in biting and chewing; within it is excauated that the weight thereof should not be offensive or hinder the muscles that moue it.

It hath also cavities to containe the marrow which is his nourishment, which are not exculped or grauen in the backpart of the iaw as in brute beasts, but more forward toward the Region of the Chin and the sides of the iaw vnto the sockets of the teeth, and therefore about these places it is thicker, as it is thinner toward the backpart.

That the lower iaw is made thicker by reason of the teeth that wereto be fastned therein hence it appeareth, because in old bodies and those who haue lost their Teeth, or where the sockets of the teeth are grown vp; in such bodies I say the iaw groweth much thinner and narrower from below vpward. These sockets, or beds, or mortize holes, or what you list to call them, wherein the Teeth are infixed, are engrauen in the embowed compasse of the iaw.

Perforations also it hath on either side two, which runne through the iaw like a Canale or pipe; for put a bristle into the hole of a iaw when it is drye on the inside, and you shall easily thrust it through the hole on the outside, and if you breake the iaw in sunder you shall finde that the way betwixt the outward and inward hole is continuall and formed round like a canale. The one of these perforations is inner and backer at the internall bosome not farre from the proccesses.

It is on each side one, and greater then the other, vnequall also or rough, beginning like a scale, [tab. 11, fig. 2, F] and through it a portion of the third coniugation of nerues is disperfed vnto the roots of the Teeth (together with a small veine and artery) which sendeth small surcles to the teeth and to the iaw.

The other perforation is small and round, grauen or thrilled without at the sides of the chin, [tab. 11, fig. 1, at G on either side] and by it the forehead nerues being now within, doe againe returne out of the iaw outward into the lower lip, and this second perforation is far lesser then the first.

CHAP. XII.
Of the Sockets of the Teeth.

IN the circumference or margent of both the Iaws, which place *Galen* called *Odontidia*, we meete with certaine cavities or hollow places which, the Latines call *Alueoli* or *Locelli*. They are digged deepe that the teeth like so may nayles might be firmler fastned in them by *Gomphosis* or by way of Mortize; and therefore the roots of the teeth are made iust fit and answerable to the holes of the law, for if they had bin broader the composition would haue been too dissolute, and if they had bin too narrow the roots of the teeth would not haue attained to their bottomes, but being fit as they are, they are very firmly contained. The number of these sockets can hardly be assigned, because they are sometimes single, sometimes double, sometime treble, according to the variety of the roots of the Teeth.

Morcouer, although they be bony, yet they appeare to be almost like wax, and may well be compared to the holes of a hony combe which are often obliterated and often againe renewed: for when a Tooth is drawne, vnlesse a new one grow vp, the hole is so constringed that there remaineth no print thereof: yea if a Tooth fall out and a new one doe rise vp in his roome, the former socket is obliterated and a new one grauen for the new Tooth.

Hence *Falopius* concludeth, that the liuely and quickning Formative faculty remaineth in the Teeth vnto the period of a mans life, for by it they encrease and receiue their forme. So in the Cheekes and the Iaw when those Teeth which we call *Genuini dentes* or *dentes sapientia* doe shoote out, haply about seuentie yeares of age, yet euen then new

Cavities.

Perforations.

The Sockets of the Teeth.

The formative faculty remaines in the Teeth.

sockets are made for them. Againe, at fourescore when the teeth fall, the sockets grow vp and the iaw in that part is so compressed that the bone on euery side cleaueth together, and at length is vnited. For the sockets are not only filled with a bony substance and rammed vp, but each partition growing to other doe make a sharpe edge which in old men serueth in stead of teeth, if not to cut, yet somewhat to breake and chew their meat. And so much of the Sockets, now we come to the teeth themselves.

CHAP. XIII.

Of the name, definition, figure, magnitude, number, site and articulation of the Teeth.

The names.



He teeth are called in Greeke, *odon*, as it were *odon* of *edon*, which signifieth to eat. In like manner the Latines call them *Dentes quasi edentes* of eating. They are the hardest of all the bones, hollow within, having small veines, arteries, and nerues: articulated to the sockets or dens of their owne law, *Per Gomphosin*, or by way of mortize, fastned with membranes, and fl sh, or ligaments, and primarily created for the comminution or mitigation or chewing of the meate.

Arguments that teeth are not bones.

That they are bones some men doe deny, first, because bones are insensible, the teeth sensible. Secondly, because bones haue certaine limits of auction or increase, neither doe they euer grow againe if they perish, but in teeth it is quite contrary. Thirdly, because they are harder then other bones. Fourthly, because bones exposed to the ayre, doe grow blacke, whereas the teeth keepe their whitenesse. Fifthly, they say, that *Hippocrates* in the eighteenth Aphorisme of the first section distinguisheth them from bones, where he saith, that cold things are enemies to the teeth, to the bones, and to the nerues. Finally, say they, there is a stone that will consume flesh called therefore *Sarcophagus*, which within forty dayes will deuour the whole body except the teeth. If therefore the teeth were of the nature of Bones, they also would be consumed.

Answered.

We answer to the first, that sense is not of the Nature of a bone. To the second, that they grow, because in attrition they are worne. To the third, that *more or lesse* doe not change the species or kind, otherwise the spongy Bones should be no bones. To the fourth, that they are accustomed to the outward aer, and haue no periostion on them, and the Philosopher saith, that that which is accustomed maketh no impression or alteration. To the fifth, that is, to *Hippocrates* authority we say, that the bones & the teeth are affected by cold diuersly, the bones onely by suffering, the teeth not onely by suffering but also by sensation. To the sixth, first we may safely doubt of the experience; secondly, we may say that the teeth are not consumed, because they are harder then other bones.

It remaineth therefore according to *Hippocrates*, *Aristotle*, and *Galen*, that the teeth are bones, for saith *Galen* they cannot be referred to any other similar part, and therefore he placeth the teeth vnder the common *Genus* of the bones, and the rather because the qualities of their matter doe agree, as hardnesse, solidity, smoothnesse, whitenesse, &c. yet there are some differences betwixt them and other bones. For among all the bones none but these haue any exquisite sense, because the teeth alone doe admit nerues into their cavity.

The teeth alone doe increase as the life increaseth, that without any detriment they might performe their Offices: for being worne in the chewing of meates they are increased againe, but onely so much as they are worne away, otherwise they would soone faile. The other bones haue no sense or but obscure, neither doe they increase alwayes, but when they come vnto their state or perfection they make a stay, because they are not changed in the performance of their functions.

How they differ from bones.

They differ also from other bones, because they are naked, hauing no periostion vpon them, for then they would be payned in the wearing; hence it was that *Aristotle* doth oftentimes, not number the teeth among the bones, but sometimes saith they are bony, sometimes that they resemble the nature of bones. And truely in their hardnesse, fastnesse, or solidity they doe exceed other bones, yea, they are little softer then stones themselves, if they bee not all out so hard, especially about their extremities. Some are stony like a millstone, others are sharpe like the steeld edge of a knife. They were made very hard that they might not weare so soone, or bee broken in the chawing or breaking of hard things, for they are not lined either with fatte, or gristles, as other ioynts are to hinder attrition. The Teeth therefore doe breake bones, resist the edge of Steele, neither can they easily, as other parts

Why they are hard and how.

of

of the body be burnt with fire. *Hippocrates* in his booke *de Cornibus* ascribeth the cause of their hardnesse to the quality of the matter out of which they are ingendered, for he writeth that out of the bones of the head and iaws there is an increase of a glutinous matter. In that glutinous matter the fatty part falleth downe into the sockets of the gums where it is dried and burnt with the heate, and so the teeth are made harder then other bones because there is no cold remaining in them.

Their outward surface is by nature white, smooth and polished, but in age for want of cate Their surface. or by disease they become liuid or dusky. There groweth also vnto them a hard scaly matter by which as also by corruption they become rugged and vnequall, yet saith the Philosopher a horses teeth become whither as he becomes older.

Their forme is before somewhat round, behind more plaine; where they are ioyned one to another they are euen, and in their extremities sometimes thin, sometimes sharpe, sometimes plaine, but alwayes vnequall. Forme.

They differ among themselves in figure, magnitude, and number. Their figure in man differeth according to the difference of their vse in chewing. In fishes they are only acute or sharpe. In those creatures that chew the cudde they are of a double forme; some *Grinders* and some *Shearers*. In men according to the three speciall diuisions of meates there are three kinds of teeth, *Shreaders* or *Shearers* called *Incisores*, *Dog-teeth* called *Canini*, and *Grinders* called *Molares*. Difference.

Againe mans teeth do not stand out of their formes as a Boares tuske, but are concluded or shut within the mouth; neither are they set like the teeth of a Saw as it is in dogs, for their teeth are giuen them in stead of weapons.

The teeth of a men are much lesse then the teeth of many other creature lesse then he, for his mouth is much lesse; for according to the magnitude of the mouth is the strength of the teeth which consisteth in their figure, hardnesse, and quantity; yea mens teeth compared among themselves are not equall but some greater some lesser, for the grinding teeth are greater then the rest. Magnitude.

The number of the teeth is not in all men one and the same, for some haue more, some haue fewer, yet the more the better, for such, saith *Hippocrates* in the sixt section of the second *Epidemion*, are long liued, where as those that haue few teeth are but short liued as *Aristotle* saith in the 3 chapter of his 2 booke, *de historia Animalium*. The reason is, because the paucity and rarity of the teeth is an argument either of the want of spermatie matter or of the weaknesse of the formative faculty. Number.

Againe, those that haue but few teeth do not chew their meate so throughly, nor prepare it so well for the stomacke. So that the Chylus is not so well concocted, and by consequence the bloud not so pure; for the second concoction which is in the Veynes of the Liuer doth not amend the error of the first concoction which is made in the stomacke. Stories make mention of some men who haue had but one tooth in their vpper iaw, and therevpon haue some been cald *μονοδοντες*, as *Euripheus* the *Cyrenian*, *Euripolimus* of *Cyprus* and *Pirrhus* the King of the *Epirots*. Some in stead of teeth haue one continuall bone, such was the Sonne of *Prusias* King of the *Bythinians*. Some haue had a double row of Teeth, as *Dripetimus* the Sonne of King *Mithridates*, *Trimarchus* of *Cyprus*. Some haue had 3 rowes as *Hercules*, for so *Caelius Rhodiginus* reporteth in the third chapter of his fourth booke. But for the most part there is but one row which is called *οεσχυς*, *Septum* the hedge, because it hedgerh in the tongue. In both iaws there are in growne bodies 32 Teeth, 16 in each iaw, in some men 30, sixteen in the vpper iaw and 14 in the neather; in some 28, which is the least number, and then the foure last are wanting, for they doe not breake out in all men nor at the same time, sometime lying imperfect within their sockets, sometimes not formed at all by Nature. Diuers rowes of teeth in some men.

And truly the grinding Teeth are the cause why Authors doe not agree in the number of the teeth, for the number of these *Grinders* is often changed, the *Shearers* and the *Dog-teeth* in man vary seldome. These Grinders are sometimes five in a side, sometimes foure, sometimes foure on the left hand, and five on the right, or on the contrary; or else foure below and five above, which variety is made by those Teeth which we call *Gennini*. The Teeth were made many not one, that they might do seuerall offices in cutting, breaking and chewing the meat; againe, that when one is pained or perished either by force or by corruption, the affection should not become common to them all. Why many teeth.

A mans Teeth are set in both parts of his mouth in the vtter compasse of both the iawes;

Fishes have their Teeth in their Pallate and their tongue : Crabs and Lobstars in their stomacke, where they are called the Lady.

Alexander Benedictus witnesseth that in a mans pallat sometimes Teeth have been ingendered, and *Eustachius* testifieth the same thing from his owne experience in a woman of Rome. Those creatures that chew the Cud have their lower gang of Teeth whole, which reacheth euen to their Lippe, so disposed and so equally ranked, that saith *Galen*, Nature is much to be commended for so ordering the dance, so he calls their ranke or course.

Their order.

The Teeth therefore are streight, inclining to neither part; before are the *shearers*, called *Incisores*, next to them the Dog-teeth called *Canini*, and then follow the *Grinders* or the *Molares* which are the hindmost, yet so that they are all disioyned with a decent and conuenable distance, which the *Gracians* call *epurion*, for they are set close one to another, and touch at the top, least that which is chewed should remaine in the spaces betwixt them and there putrefie.

The roots of the Teeth doe enter into the holes or sockets of the iawes, to which they are so fitted, that a nayle sticketh not faster in a post then they do in their proper places, euery rooth being compassed with slender processe and cauities of the iaws which hold them fast that they fall not out or be shaken.

Their Composition.

Euery Tooth also saith *Galen* hath a nerue, and that nerue helps to establish it, for when the nerue is loosened with too much moysture, the Tooth becomes prominent and mouable : beside they are very strongly tyed by Ligaments which passe betwixt their roots and the bottome of their sockets. The Gummies also doe establish the teeth very much, fastning about them very exactly; and this *Commisura* of the Gums and the colligation of the iawes, *Rufus* calls *habena* or the bridle. In a word the Teeth are vnited by the interposition of nerues, membranes and flesh. The nerue is inserted into the cavity, and so the Teeth may be said to be ioyned by *Synneurosis*. The fibres of the membranes do cleaue to the roots of the Teeth : the flesh compasseth them about, which being eaten away, they either grow loose or fall out, and so they are ioyned by *Synsarcofis*.

Is by way of mortize.

Hence we may gather that the articulation of the teeth is by *Gomphosis* or by *mortize* which is a kind of coarticulation, and yet *Galen* doubteth hereof and saith, that their composition commeth neare to a Coalition : neare it may be, but indeed they are coarticulated, which may be proued, because when for want of nourishment they grow dry and begin to wither, then their coniunction is not so stedfast but loose and vncertaine, which hapneth also when the nerue vnder them is ouer moyst. Finally, their rootes are simple, double, treble and fourfould.

CHAP. XIII.

Of the Shearers and Dog-teeth.

3^d Kindes of teeth. Both in view and generati on. *Incisorijs*.



WE said before that according to the three kinds of diuisions of Meats, there are also in men three kinds of Teeth called *Incisorijs*, *Canini* and *Molares*. *Incisorijs* wee call the *shearers* or the *shreadors*; [*ta. 11. fi. 3, D 1, 2*] they are seated in the forepart of the iaw, and because they are the first, they are called by *Hippocrates* and *Aristotle* *πρόσθιοι, primores*.

They are sharpe edged like a knife and broad also, the better to deuide that that comes betwixt them, and are therefore called *πρῆτοι*. Sometimes they sheare a thing asunder as a paire of pinsons doth a wire, and that is when the lower teeth are vrged, not against the ends of the vpper, but higher toward their bodies. And because these Teeth in laughter are discovered, therefore the *Grecians* call them *γέλαιοι*.

Are foure.

These *Shearers* are for the most part foure, and those two that are next the *Dog-teeth* are lesse then the other, and shorter then the *Dog-teeth*. [*table 11, figure 2. character 2*] *Gorrenus* saith that some men in stead of these foure, either aboue or below haue onely two, but those so broad that they take vp the roome and performe the vse of foure. Some againe in stead of foure *shearers* haue sixe, eight, or more placed without any order, some of them being right, others crooking outward to the Lip, others inward into the mouth, which are so offensive both in chewing and in pronounciation, that we are constrained sometimes to draw them, sometimes burne them, sometimes to file them. *Bauhine* maketh mention of a Doctor of Diuinity, whose two fore-teeth in the lower iaw were double, for when the two vpper were almost consumed about the fortieth yeare of his age two other grewe vp within them. The part of these Teeth which standeth without the Gummies is narrower betwixt the Basis and the sides, but before and behind thicker, growing thiane and broad by degrees vnto the extremity : especially it is so in the vpper two which are called *dnales* and *pala*.

Pale, because they are very like vnto a pale: the superficies is on the outside, somewhat gibbous, and againe a little hollow on the inside. The other part of these teeth which is infixed in the law is toward the side flatted or compressed, and endeth in a sharpe point; for they root is but single; yet greater for the most part, at least as great as any the rootes of the great teeth: hence it is, that they easily fall out, especially those in the vpper law. In the extremities of these Teeth, when men are growne to some age, there is either no perforation at all, or if it be it is wondrous obscure.

Next to these are the Dog-teeth, called *Canini*, [tab. 11 fig. 3 char. 3] by *Aristotle* and *Galen* *κυνόδοντες*, not so much for their figure, or because they stand out of the gummies as Dogs teeth doe, as for their vse; for in dogs after the shreading teeth, there are two kindes of sharpe teeth; Some standing outward, others of a triangular forme. But a mans dog-teeth differeth from them both. They are onely two in each law, because a man is a milde and ciuill creature, whose strength consisteth more in wisdom then in fortitude of body, and therefore is not full of Dog-teeth, as other furious and rauening creatures are, and to break that which is hard two were sufficient. These go betweene the sharpe teeth and the plaine, the Shearers and the Grinders, and below at the gummies are broad and thicke, aboue sharpe and somewhat prominent beyond the course or order of the teeth. From the Shearers they differ, because they are thicker and their head somewhat narrower but not so sharpe. They are also harder, that if any thing by chance doe come betwixt the teeth which the Shearers cannot diuide, these may breake it; for the shredders were made to cut meat short, and these to breake that which is hard.

Their rootes, as those of the shearers are but single, yet infixed deeper, stronger also and lesse pressed, or narrow before then behinde. These rootes are longer then the single roots of the rest of the teeth, yet so that the vpper are sharper and longer then the lower. These they call the eye-teeth, not that they are so produced that they touch almost the lower circumference of the eye, for they do not go aboue the lower end of the wings of the nose, but because a portion of the nerue which moueth the eyes is deriued vnto them; and hence it is commonly and truly said, that to draw the eye-teeth is not without danger.

CHAP. XV.

Of the Grinding Teeth.



The great Teeth the Grecians call *μύλοι* or *μύλοι*, *Molares*, because by them the meat is broken as Corne is broken vpon a Mill. They are seated in the inner part of the mouth, and hidden by the cheekes: the reason of this position is, lest the meat already shred or broken, and by the tongue rowled vnto the teeth, to bee further ground should fall out of the mouth. In their vse therefore, and likewise in their forme they are like vnto a Corne-Querne, vnequall, rough, hard, broad and great: Rough and vnequall, for so they are more fit for comminution, and that is the reason why Millers when their stones are growne smooth doe picke them anew. But these Teeth in old men by long attrition doe become equall and smooth, and by reason of their perpetuall vse, are sooner broken and eaten out, then the rest.

Wherefore that part of these grinders which standeth without the gum is foursquare, and that square more perfect in the 3 hinder teeth: and though their tops are very large in fomuch as *Ruffus* in the eight chapter of his first Booke calleth them *παραζαι*, *Tables*, yet they are not smooth, but every one, saith *Eustachius*, hath a pit one or two in the midst: whence it cometh to passe that their extreame or outward parts are somewhat high. Those two that are next the Dog-teeth are heightned on the inside and on the outside, yet the first especially in the lower iaw doth sometime want his inward eminence: the third protuberateth or swelleth vp in foure corners: the fourth and the fift for the most part haue two eminences on the outside, on the inside but one. These cauities and protuberations meeting iust one with another do hold the meate faster that it fells not so easily from betwixt them.

They are the hardest, saith *Vesalius*, of all the bones, that they might not so easily weare away; broad also and plaine the better to leuigate the meate that is already shorne and broken by the other teeth; for it was not fit that a man should swallow his meate before it were perfectly ground: beside being so ground, the heat and moisture of the mouth assisting, there is made in the mouth a rude inchoation or beginning of concoction.

They

Dog-Teeth.

Two in each law.

Their rootes.

Eye-teeth.

The Grinders.

The forme.

Magnitude.

They are called also *σοφιστοι*, not because their insertion is by way of mortize, for that is common vnto all the Teeth, but *απο της ρομφαιδσεως*, that is, from the rough superficies of a Mill-stone, whose figure and vse the vpper parts of these grinding teeth doe elegantly imitate. In Magnitude they differ, for the middlemost are the greatest, and those on each side lesser. The third is the greatest of all in Men, in Apes the fourth and the fift; for it was not fit that the internall capacity of the mouth which groweth narrow as the anterior part doth, should haue teeth so great as the middle where it is broadest of all. Sometimes to the fourth or the fift (but in the vpper iaw rather then the lower) there is adioyned as it were a halfe tooth, for Nature con- tending to make more grinders, is hindred by the narrowness of the place, and therefore is constrained to ioyne them together.

Number.

Their Number is commonly in the vpper and lower lawes on each side five, that is in all twenty. The reason why there are more grinders then shearers is, because Nature doth vse according to the largeness or narrowness of the fissure of the mouth to allow creatures more or fewer of this kinde. Man whose mouth is very narrow, and whose teeth were specially giuen him to chew his meate, hath therefore more grinders then shearers or dog-teeth: on the contrary in rauinous creatures there are more shearers and grinders, because they vse them as weapons. Hence it is, that in men there is little difference in the number of their Shearing or Dog-teeth, but of Grinders there is great variety: some- times five, sometimes foure, sometimes sixe. *Eustachius* did neuer obserue so few as three, sauing once in a Cardinall. It may be his lawes were short. And this variety *Galen* makes mention of, although there be no such variety in Apes; whence saith *Eustachius* (and the ob- seruation is very good) it may well be concluded, that *Galen* did vse to cut vp not apes onely but men.

The teeth of wisdom.

The two latter grinders both in site and generation, are called by *Hippocrates* in his Booke *de Carnibus* *σοφιστοι*, the Teeth of wisdom, because when they grow vp a man beginneth to be wise: for they arise about the fourth Septenary, that is, at 28. yeare old, at what time men are, or should be temperate and moderate. In the breeding of these teeth there is some- time great torment and paine, and therefore *Auicenna* calleth them the teeth of Sense. They spring vp sometime in old age, and therefore *Aristotle* calleth them *ραντις*, because they per- fect the age or groweth: the Latins call them *Genuinos*, to which Teeth this is peculiar, that they doe not begin to breake out till all the rest haue bene a good while perfect. Sometime also they onely perforate the Gummies but rise little aboue them; sometimes they lurke all together in the iaw, and are couered with the Gummies, sometime they are not created at all.

Their rootes in Apes.

The roots of these Teeth are perpetually of one forme in Apes, as *Eustachius* elegantly de- clareth; for in them the grinders of the vpper iaw haue three roots: of the lower iaw two, ex- cepting sometimes the fift; the fourth as it is the greatest, so are the roots thereof greatest. In Men their roots are not alwayes of one forme, yet most what they are many and alike: some- time in the fift of the lower iaw, (in the second also *Eustachius* obserued the same) which be- cause of his magnitude a man would thinke should haue many roots, there is but one, thicke and perforated with one broad hole. Other roots of the Teeth haue an equall or vnequall superficies, and within two or three holes skilfully thrilled and disseuered by thin scales, much like a Hony-combe. In the fift grinder there are three, in most of the rest two. Oftentimes the roots grow together, sometime they are separated, sometime a man cannot perceiue so much as the line that parteth them.

Their figure.

The Figure also of these Roots is diuers, for some are round, others streight and accute, others obtuse, plaine and crooked, They differ also in magnitude, the roots of one tooth be- ing thicke sometimes, sometimes narrow, of another short, of another long, of some broad and thin, yet for the most part the roots of the vpper teeth are long and of the lower teeth shorter.

Situation.

They vary also in situation, some touch one another, some growe neare but touch not, some straddle one from another like the feete of a stoole. Againe, some stande off one from another, but yet are so incurued that their extremities do touch, others running foure wayes are in their ends most of all disioyned, and these in drawing of Teeth are sometimes broken and put the man to cruell torment.

If there be three roots, especially in the vpper iaw, one runneth inward and two out- ward. To conclude, commonly the two vpper grinders which are next to the Dog-teeth are fastned into their sockets with two roots, the other three with three. Sometimes, the

fift

first hath foure which is rare. Again, the two lower Grinders which are next to the Dog-teeth haue but one roote, the three others two. Those Teeth which we call *Genuini* or *Teeth of wisdom*, haue very short rootes, partly because that portion of the iaw will not admit a deepe insertion, partly because in the leuigation or chewing of meat they are not in so much vse as the rest. Wherefore the roots of the grinding Teeth of the lower iaw are fewer and shorter then those of the vpper, because the substance of the lower iaw is harder and more solid, and therefore better able strongly to containe the Teeth, and to beare their waight; but in the vpper iaw, which is more rare and soft and wherein the Teeth hang, and therefore are more subiect to fall out with their owne weight, their roots are longer, the better to fasten them, for they needed more ties as it were to binde them and to containe them within the iaw.

Hence it is that where the roots are shorter the Teeth are drawn with lesse danger, but with more labour where they are many, especially if the roots grow vnto the sockets.

The roots of all the Teeth are perforated euen into their internall cavities, yet this perforation in perfect and growne Teeth is very small, and that in the sharpe point or top of the roote through which a veyne, & an artery and a nerue are admitted; of which Vessels we will speake in the next place, but briefly because we haue touched vpon them before.

CHAP. XVI.

Of the Vessels and Sense of the Teeth.



Through the holes of the roots of the Teeth all manner of Vessels doe run and are diuersified in their internall cavities; veines first to bring them plentifull nourishment. Now it was necessary that the Teeth should alwayes grow, because in mutuall attrition they weare one against another, and this we may certainly conclude by our owne experience. For if a tooth fall out or be drawne, that which groweth opposite against it will be longer then the rest of the Teeth of his owne ranke, because it is no more worne by the Tooth that before was opposite against it, the rest of the Teeth by their mutuall attrition in chewing of the meate are impaired and againe so much increased.

Arteries also doe enter into the Teeth to preserve and keepe their naturall heat; hence it is that in inflammations there is a beating or pulsing paine felt, such as fleshy parts feelee when they are inflamed. And this *Galen* first of all men obserued in the 8 chapter of his first booke *de Compositione medicamentorum secundum loca*, for he found in himselfe not only paine but a pulsing paine in his Teeth, whence he concluded that there was one paine in the Gums, another in the very substance of the Tooth. Yea without any inflammation of the Gums sometimes there is paine in the proper body of the Teeth, sometimes in the nerue.

And againe vnlesse vnder the Tooth there were an artery, how could so much florid and pure bloud issue when the Tooth is perforated, which *Eustachius* obserued in a man that fell into such a flux of bloud from his tooth that he had like to haue died vpon it.

They haue also nerues soft and slender which come from the third coniugation commonly so called, and runne through their rootes in their cavity euen from their first conformation; where they are disseminated, and their small fureles are mixed with the mucous matter of the Teeth; hence it is that when that mucous matter is become bony yet it easily consenteth with the nerues, and so the Teeth become sensible; whereas to other bones there are no nerues at all conuayed which may be dispersed into their cavities. And therefore it is truly said that bones want nerues although the membrane which is called *Periostium* haue sense and nerues in it. Wherefore when this *Periostium* which is of exquisite sense is affected, the paine may be thought to be in the bones themselves when it is only in the membrane: so in a Cicatrice which hath no sense we imagine we feelee paine when indeed the paine is onely in the neighbour parts; and the membrane which inuesteth the Liuer being affected we thinke we feelee paine in the Liuer whereas the *Parenchyma* or substance of the Liuer it selfe is insensible: vnlesse any man will say that the bones haue sense by the helpe of the Sensatiue soule by which they subsist: and yet that very obscure, because the hardnesse of the bones doth very much resist any such sensation; and thus we may say that bones do differ from plants as being particles of a sensatiue creature.

Their perforations.

Veines.

Arteries.

Nerves.

How teeth haue sense.

These

How to demonstrate the Vessels of the Teeth.
Eustachius.

These nerves of the teeth are very small, yet in our Table we have made them large, imitating therein *Vesalius* and others. But by what order and manner of dissection, we use to make demonstration of the vessels and nerves of the Teeth, saith *Bauhine*, we will now relate as we learned it out of *Eustachius*.

These vessels are better demonstrated in the iaw of a great creature, as for example, in an Oxe, then they are in a Man: and againe the administration is easier in the lower iaw then in the upper. We take therefore the lower iaw of an Oxe and open it on the inside, and presently we meete a cavity full of marrow, together with the nerve inuolued in a membrane; when we have remoued the marrow and slit the membrane throughout his length, then may wee perceiue the nerve made as it were of many strings, betwixt which do run propagations of veines and arteries. Moreover, if you remoue this membrane with the surcles of the nerves and vessels a little vpward from the bone carefully that you breake them not, you shall perceiue some fibres distributed from the membrane not vnlike the Lawny threds of a cobweb. In like manner in the iaw of a Ramme certaine fibres do penetrate the bony partition which is betwixt the Nerve and the Teeth, but these fibres are most conspicuous at the roots of the grinders.

From these *Grinders* vnto the *Dog-teeth* and the *Shearers* there is a nerve conueyed accompanied with an artery: the nerve is deuided into two; one part of it, through a hole in that place, breaketh vp at the lower Lip, and a branch of it runneth along vnto the *Shearers*, and affoordeth a small surele to euery one of them; another portion of it is ioyned with the vtter part of the roots: the second part (which is also the slenderest) beareth into the cavity of the teeth, and may euen without any greater difficulty be discerned euen in men.

And truly it is a strange thing that the *Shearers* and *Dog-teeth* which are the lesse and haue but one roote, haue notwithstanding allowed them great and conspicuous surcles of vessels attaining to their insertion by a broad and open way; whereas the *Grinders* which are the greater (and haue three, sometimes foure roots) are allowed but small and capillary surcles made of the former, doubly, trebly and foure-fold deuided, and creeping obscurely into their insertion.

Againe, if a *Grinder* or a *Shearer* be gently and by degrees drawne out of his socket, you shall finde to arise with it out of the cavity of the iaw very small fibres which are ioyned to the roots of the Teeth: you may also obserue that the parts of the bony partition are full of a mucous substance which is not vnlike to that whereof the teeth and their huls or huskes are generated.

Againe, when the Tooth is drawne, in the extremity of his roots you shall find a matter partly mucous partly fibrous, which cartieth a resemblance or shew of a nerve, a veine and an artery.

But if you deuide the Tooth in the middest you shall find a mucous substance wouen with vessels and some fibres: but these things may be better seene in the iaw of an Oxe or of a Ram then of a Man; and yet euen in a man diligent search will find them out, though they be not so conspicuous.

Wherefore who can deny but that there is a Pulsatiue or beating paine euen in the inner part of the tooth, as *Galen* and *Eustachius* haue witnessed, when he shall perceiue an artery and a nerve attaine therinto? For veines, why should we not likewise beleue that they enter into the Teeth, when we see it sprinkled with bloud in men; and in Oxen may manifestly perceiue the vessell it selfe? for it is in the tooth as it is in that coate of the eye called *adnata*, as long as a mans Eye is well disposed the veines therein are not visible, but then onely become conspicuous when it is inflamed.

Of the sense of the teeth.
Divers opinions of Anatomists.

Concerning the Sense of the Teeth, the opinions of Anatomistes and Physitians are very diuers. Some thinke they haue no sense at all, because they are bones and may be filed without paine; others thinke they haue Sense, but that of themselves without nerves, as other bones haue: and these men imagine that the paine of the tooth is without it, that is, in the membrane which compasseth the socket: others thinke they liue and haue Sense by their inbread heate. *Aristotle* determines that they feele cold sooner then heate, and are more affected by it: *Galen* saith they are pained, they beate and receiue soft nerves. But the question may be asked what part of the tooth hath this Sensation? *Varolius* answereth the body of the tooth, but on the inside onely. Others say that the whole Tooth indeede hath Sense, but the whole Tooth doth not feele paine; it perceiueh the first and second qualities

qualities, but the first qualities onely doe paine it, because they exercise their power vpon the roots of the teeth, into which certaine small nerues doe penetrate. This was *Archangelus* his conceit, and *Laurentius* hath almost the same. The whole Tooth (saith he) doth feelee, but more exquisitly on the inside, more dully on the out.

Another question may be asked, whence comes the sensation that paineth them? some answer, that it is by reason of the nerues and of their proper substance, so saith *Actuarius*. *Falopius* thinks the paine comes by reason of a thin membrane compassing about the inner cavity. Others ascribe the cause to the nerue and the membrane ioyntly: others to the nerue which cleaueth to the neighbour parts and to the roots of the Teeth onely. Others to the nerue that entreth the Tooth and a membrane that cleaueth to the roote thereof as it were a *Periostium*. Others to a nerue which penetrateth the substance.

These and such like are the diuers opinions of Anatomists concerning the sense of the Teeth. *Bauhine* interposeth his opinion on this manner.

The teeth, saith he, do feelee, and the faculty of sensation is communicated to their substance by the mediation of a very thin membrane which compasseth the inward cavity of the Tooth lightly hanging vnto it, and also of a soft nerue which attaineth into the same cavity: thus the Teeth haue a proper kind of Touching which we cannot in words so well expresse as by instance. For vpon the eating of sowre or sharpe meates the Teeth are affected with a kinde of stupor, and then we commonly say our Teeth are set on edge, which kind of sensation is proper only to the Teeth and the Gums, and is nothing else but a Symptome of the rouching faculty.

But we must conceiue that each part of the Tooth is not equally sensible, but that the inside which is nearest to the nerue and the membrane is of quicker apprehension then the outside; for the outside, partly because of the spisse and hard substance which like a shell couereth the inward part of the Tooth, and doth not admit the power of the nerue or the impression of the animal spirit, partly because it is continually accustomed to the mutations that come from the ambient ayer is not so sensible. Euen so we see that the callous skinne in the hands and feete of a labouring man is almost altogether without sense, though the skin it selfe naturally disposed be very sensible.

Wherefore that part which is without the Gums or the shell of the Tooth is not offended by hard and rough things, for though it bee cut or filed, or burnt with a hot yron, yet it is not pained, neither is there any sense or signe of sense following thereupon, especially the height or top of the tooth which was made solid to breake the meate, and therefore the cavity not attaining so far the nerue also commeth short of it.

The reason why a part of the body of the tooth is not pained by fire or by hot rion, *Aritius* saith is knowne onely to the Gods. As for vs we can say nothing but that it is a peculiar to the teeth that they are not equally affected either by all things that make alteration in them, or by those things which might offend them; but are more affected by heat and cold then by any other qualities, and by cold more then by heate, yet to giue some satisfaction, we say, that the teeth are not offended by moist or dry by soft or hard things because their qualities are not so suddenly communicated to the membrane or to the nerue. But they are affected by hot and cold things because the animall spirits which are contained in the substance of the tooth and diffused through the same, are thereby altered; for those actiue qualities do pierce on euery side, affecting and changing together with their substance the animall spirit and by succession also the membrane and the nerues. And truly it is very reasonable to imagine that in the substance of the teeth there are great store of animall spirits more then in other bones, first because they receiue soft nerues into their cavities, and againe because their internal substance is somewhat rare, made of a mucous matter condensed or thickned.

Obserue also that the paine which is felt in the substance of the tooth differeth much from that paine which is in the Gums, either from their distemper or from any flux of humor into them, and from the payne which is felt in the nerue that runneth vnder the roote of the Tooth.

The vse of their sensation is thought to be, first that being exposed to outward iniuries, and hauing no *Periostium* to compass them about; it was fitte they should haue an ingenite principle of Sense that they might be able to discerne betwixt that which is profitable and hurtfull.

Again if we will beleue *Galen* in the second Chapter of his 16. Booke de vsu partium, as all the other parts of the mouth, so likewise the Teeth doe after a sort discerne of sapor

Bauhine's resolution

Great store of animall spirits in the Teeth.

The vse of their sense.

or

or Tastes, and for that purpose they receiued soft nerues. For as the skin hath Sense, yet through the cuticle or scarffe-skin which is not sensible; so the marrow of the tooth is apprehensive of tactile qualities through the bony part, like as the nervous membrane which is vnder the nailes doth feele heat and cold through the nailes which haue no sense at all. And so much shall haue beene sufficient to haue spoken of the Sense of the Teeth. Now we come vnto their cavities.

CHAP. XVII.

Of the inward cavity and Membrane of the Teeth.

The cavity of
the teeth.

WE said before that the Vessels and the Nerues did enter into the cavities of the teeth, and therefore it would be very fit we should acquaint you what this cavity is.

All the Teeth are hollow on the inside, [tab. 11. fig. 3. B] but this cavity is greater or lesser according to the magnitude or figu. of the Teeth, which thing also *Aristotle* acknowledge in the 7. chapter of his 3 booke *de historia animalium*, where he saith that the teeth are bones partly concavous and partly solid. Notwithstanding some new Anatomists haue been so impudent as to challenge to themselves the inuention or finding out this cavity. *Galen* indeed in those bookes of his which are extant, doth not write how great or what a kind of cavity this is, nor yet what is contained therein; yet because oftentimes he makes mention of the *Dennes* of the Teeth, it is not likely that he was ignorant of them; for if he had beleueed that the teeth in their first originall had had no cavities, it had beene an idle thing for him in vehement paine of the teeth to command that their solid substance should be perforated with a small wimble or piercer, in the ninth chapter of his 5. booke *de compositione medicamentorum secundum loca*. Again, *Hippocrates* in the 4. *Epidemi*an reporteth that a Childes Teeth were eaten with a corroding vicer, those especially that had cavities or were hollow, whereby *Hippocrates* doth insinuate, first that the substance of the Teeth may be corroded, and secondly that they haue a naturall cavity in them.

The humour
therein.

This cavity is in children of seuen yeares old and somewhat vpward very large, and circumscribed with a thin scale very like vnto a hony-combe. It is also full of a white humour, not of marrow, such as we may see in the sweet-tooth of a Calfe when it is brought sodden vnto the Table, but this humour in proceffe of time is dried, becomes harder, and for the most part turnes bony, and so the cavity is euery day diminished; yet so that in the midst at the roote there remaineth alwayes a *Sinus* which scarcely reacheth aboue the height of the Gums: for it was necessary there should be an empty space left, because of the insertion of the vessels and the dilatation of the artery: yet some men affirme that the pulsation we feele in our teeth doth not proceede from the beating of the artery, but from a spirit or ayre moued, as sometimes we find it to be in our eares.

Three cavities
in a Calues
tooth.

These things saith *Eustachius* are best perceiued in the Grinding teeth of an Oxe broken; and in a Calfe and a Lambe each grinder hath three cavities, one anterior another posterior and the third in the midst; and the middlemost cavity is perforated with a crooked hole like the letter C which reacheth as farre as to the top of the Gums: in the two other cavities there is a mucous matter contained, which for the most part as the Tooth growes perfect turneth bony. Beside, because in these creatures we find oftentimes two, sometimes three, sometimes foure grinding Teeth ioyned together, Nature to make a mutual consent between them, hath perforated the bony partition with a transuerse hole, through which a matter like a small membrane passeth out of one cavity into another, as furcles of vessels do passe through their perforations.

This cavity is compasse d with a membranous substance, which *Falopius* and *Laurentius* call a thin membrane. *Goreus* saith it is a production of the *Pia mater*. *Columbus* esteemeth it to be made of a complication of veines, arteries and nerues, which imbibeth or sucketh vp the matter that falleth vpon it, from whence come the greatest and most intolerable paines of the tooth-ach.

And indeed this membrane is of most exact Sense, and by it the Teeth are so apprehensive of heate and cold: yea saith *Bauhine* we consent with *Columbus* herein, that the fluxe of humour out of the Brain vnto this membrane is the true cause of the greatest paines in the teeth which do so long endure as the humour is detained in the Membrane; or till the braine bee purged, and so the cause of the fluxe be taken away.

By

By reason of this cavity if the teeth be perforated by an affluence of sharpe humors, which perforation doth reach to the cavity, then are the teeth quickly rotted even vnto the roots; againe in this cavity, especially the erosion and putrifaction of the teeth doth begin. In it groweth that delourous rottenesse, and in it sometimes are wormes gathered which doe miserably excruciate and punish the patient. The vse of the cavity is, that by it the teeth may be better nourished, and receive the faculty of sensation.

How the teeth
rotte.

The vse of
their cavities.

CHAP. XVIII.

Of the generation and vse of the Teeth.



Concerning the generation of the Teeth, there are diuers opinions; some thinke they are generated within the Wombe, as *Columbus* and *Eustachius*; some without the wombe, as *Aristotle*; some partly within and partly without, as *Hippocrates* who maketh a threefold time of their generation, in his Booke *de Carnibus*, of a threefold Aliment which ministreth matter vnto them. The first is from the sustenance they receive in the wombe; the second is after birth by the Milke which the child sucketh; the third is after he hath cast his teeth by the meat and drinke that he eateth whereby new teeth are engendred: for, saith he, whatsoeuer is glutinous in the Aliment that maketh the Teeth, but the fatty part (which heere is more plentifull then in the matter of the rest of the bones) is exccited by the power of the heat. Also (saith *Laurentius*) as this threefold kind of Aliment differs in thicknesse, so doth the solidity, hardnesse and thicknesse of the teeth vary, for those teeth that are engendred of the Aliment which the infant vseth in the wombe, or when he suckes his mothers brest, are but soft, and doe easily fall away, but those that are made of more solid meats are also firmer.

Diuers opini-
ons conce-
ning the ge-
neration of
the teeth.

The truth is that they are generated in the wombe together with the rest of the bones; with which they are not delineated but formed and absolved by degrees: wherefore they lye for some time imperfect in the lawes, neither do they all breake their prisons at the same time, but some sooner, some later, according as the necessity of Nature doth require. And this is the cause why some made a double time of their generation, one in the wombe; another out of the wombe.

The truth.

In the wombe after the generation of the lawes there are twelue Teeth formed, foure of which are *Shearers*, two *dog-teeth* and six *Grinders*, all which doe want roots, and lye hid in their sockets, on euery side compassed therewith, and the gums whole about them. And this may be seene in the iaw of an abortiue infant or other creature, yea if it dye presently after the birth; for if you cut vp the law you shall finde Teeth therein. Some haue bene borne with their Teeth out of their gummies, as of old time *M. Curtius Dentatus*, and *Cn. Papyrius Carbo*. Of later times, the same is reported of *Richard Crooke-backe* the Vsurper.

The substance of the teeth being yet imperfect is partly mucous and partly bony, for if you take away the huske of the Tooth, (for there is about euery Tooth such a white, mucous and slimy substance somewhat membranous wherewith the tooth is couered, which also is so much the more mucous by how much the tooth is the softer and the younger) perforating it in the vpper part, that the end of the Tooth may peep out, then shall you perceiue that the tooth is partly bony, partly mucous; for that part which was to rise aboue the gums is fashioned into a white scale, thin and excauated or hollow like a Honey-combe, and so the vpper part of the Tooth is bony, hard and hollow. The other part which should haue remained infixed in the law, is soft, moyst and mucous, like the substance that is in a young quill.

The substance
of the Teeth
diuers.

Third hard
part.

The soft part.

This substance seemeth to haue fibres and threds and to be couered as it were with a thin coate, for the superficies thereof is like to a smooth tunicle fastned and conioyned to the substance that it containeth: wherefore a resemblance of the generation of the teeth wee haue some-what expressely in the generation of a quill: for the part which is without the skin is horny and hard, but that which is within the wing is softer and moyster, yea sometimes like blood or congealed Phlegme. This soft part of the teeth as they breake the flesh hardneth by degrees, and by degrees becommeth bony. Sometimes also it is hollow within and formed into roots.

The hull or huske of the Tooth whereof we spake euen now serueth in stead of a Ligament, for by it the rooth is fastned as with glew to the socket and to the gums.

In Infancy the Teeth be within the Gums that they might not byte the Nurses nipple: the seuenth moneth they begin to breake out, or later saith *Hippocrates*, if the Infant do tooth with a Cough, and then they are troubled with Agues, Convulsions, Scowrings and such like, especially when they breede their *Dog-teeth*. *Galen* rendereth a reason, because when the Gums are perforated by the Teeth the paine is as violent as if a goade were thrust into the flesh, but indeed the teeth are more painfull then goades, for if a goade be once fastned it resteth, but the tooth issueth still to the extent of his augmentation.

The times of
dentition.

The first.

The Teeth breake out not altogether but the vpper sooner then the lower, and the Shearers sooner then the Grinders: that they issue later in men then in brute beasts (for the Elephant, saith *Aristotle* in the 5. chapter of his 2. booke *de hist. animal.* breedeth his teeth as soone as he himselfe is borne) the reason is saith *Aristotle* because a man about all creatures hath less of that earthly excrement whereof they are ingendred. But because the first Teeth and those that follow them which are though to be regenerated, doe lye hidden in the iaw-bone, therefore we rather say that the cause of their late issuing in men is to be attributed to the good will and pleasure of him that made them, who moderateth all things according to his owne wisdom; yet when the childe comes to chewing, that he might cease to be troublesome to his mother, and not lye alwaies lugging at her breasts but fall to stronger kinds of meate, therefore at length Nature puts them forth; for euery particle is then accomplished when Nature standeth in neede thereof, and this is the reason why the Teeth are not formed till after the birth. For this cause also saith *Aristotle* the Shearers doe yssue before the Grinders, because the meate is first shred before it be ground.

Dentition or the breeding of the teeth begins about the second yeare, sometimes sooner, but then saith *Hippocrates* in his booke *de carnibus*, they are ingendred of an ill humour. The first Teeth that arise are the fore-teeth; *Democritus* saith because their sharpe ends make way before their due time. *Aristotle* reprehends him and giueth another reason, because that which is sharpe doth soonest grow blunt: and therefore Nature sendeth a supply of others; the broad Teeth are not blunted at all but onely leuigated by attrition, and this is *Aristotle* his conceite in the 8. chapter of his fift booke *de generatione animalium*.

When the first Teeth about the seuenth yeare are either drawne or thrust out by those that come vnder them, then do those first Teeth appeare soft and as it were hollowed: and therefore some haue thought them onely Appendances of certaine roots left in the iaw, of which roots, as it were of seede, a new hope or succession of teeth is brought forth. *Vesalius* therefore counsels vs to take heed that when a childes tooth is broken by accident we do not draw the roote, for then haply the tooth will not grow againe. But Anatomy teacheth vs the contrary, that is to say, that there is no coniunction betwixt the imperfect teeth that fall at seuen yeares of age and the perfect that arise after. Nay they do not so much as touch one another, for there is a partition in the middest betwixt them before the new tooth can breake forth. And thus much of the first time of the generation of the Teeth within the wombe.

The second
time.

The second time of their generation is without the wombe, about the seuenth yeare, and these teeth are commonly thought to be regenerated; but to say truth and to speake properly, they are then neither generated nor regenerated. For together with the first Teeth in the beginning of generation they doe receiue with the rest a rude kinde of forme, and are made of the same matter; otherwise we must be constrained to confesse, (and that were very absurd) that Nerves, Vessels, Ligaments and Membranes which are spermaticall parts and doe consummate the frame of the Teeth, doe begin their generation after the Infant is borne seuen yeares, more or lesse. It is true indeed that these latter Teeth are not sooner absolued or perfected then in the seuenth yeare or thereabouts, and the proportion seemeth not to be much amisse, for they first breake out of the Gums about the seuenth month, and the second about the seuenth yeare. And this proportion *Hippocrates* in his booke *de septimestri partu* standeth much vpon, not only in the production of the Teeth, but also in other mutations in the body of man.

Galopius conceiueth that the latter Teeth are made of the same matter with the former by the seminary faculty which remaineth in the iawes, and *Eustachius* confesseth that if you remoue the bony partition that is betwixt the first and the later teeth, you shall finde the feedes of the Teeth one vnder another, I meane of the Sheares and the Dog-teeth, but

but of the Grinders he neuer found any feedes; and yet he thinketh it reasonable that they should have a rude originall in the wombe which is accomplished afterward at leasure.

The teeth which about the seventh yeare breake out, or as some say are renewed, are in either iaw ten, foure Shearers, two Dog-teeth, and foure Grinders or Maxillaries, that is, two next vnto the Dog-teeth, and two that are called *Genuini* or *Teeth of wisdom*. The shearing teeth when they breake forth do thrust the first shearers out before them and issue betwixt the two first, the second, and the Dog-tooth that is next vnto them. But if the former teeth will not fall or be not pulled out, or if the latter issue before the first fall, then the latter worke their way through new sockets and turne in the vpper iaw outward, in the lower iaw inward, so that there seemeth to arise a new row of teeth, and this indeed hath deceiued many Historians and some Anatomists also.

The Dog-teeth also do fall out and the place of the succeder is a little on the one side the roote of the former.

The reason why the teeth about the fourth fift sixt or seventh yeares do grow loose, is because the sockets do continually increafe and the teeth are but soft and therefore doe soone perish, because the harder Aliment which from thenceforth accreth vnto them is nothing conuenient to their substance, and then they putrifie and fall away: but those teeth that breake out at the seventh yeare receiue nourishment agreeable to their substance, & therefore do continue as long as their nourishment is supplied. Among the grinders the two first doe sometimes thrust out their predecessors, but for the most part they arise at their sides and increafe the number: those two that are called *Genuini* do neuer thrust out them that were before them, but yssue sometimes in extreame old age, in the very ends of the iaws; yea *Aristotle* reporteth that these teeth haue arisen not without great paine after fourescore yeares. Notwithstanding this is more rare in men then in women. *Hippocrates* in his booke *de Carnibus* witnesseth that these teeth which grow vp so late doe wax old together vnlesse by mischance they fall out or perish.

The manner of the generation of the teeth *Falopius* thus expresseth. The quickening faculty by an aërie spirit makes the bone hollow; at the same time is ingendered a membranous huske which hath two ends, one posterior whereat a small nerue, a veyne and an artery doe meete. The other anterior whereat hangeth a neruous tayle like growne Malt: and this taile creepeth through a narrow perforation of the bone to the side of that tooth which hath a successor and so passeth vnto the Gums.

In the foresaid huske there gathereth together a white and slimy matter, and the first part of the tooth becomes bony when as yet the latter part is soft, euen so as we said it was in the teeth formed in the mothers wombe.

Euery tooth issueth through that hole dilated, through which the tayle or beard of the huske was transmitted. Instantly the huske is broken and becommeth as we said before a ligament to the tooth, and the tooth it selfe issueth naked and hard, notwithstanding the hardest part of it receiues a further perfection by induration of his matter without the Gums.

The primary and first vse of the teeth was to deuide, to breake, or chew or mitigate the meate and so to prepare it for the stomacke. Againe, another vse of the teeth is for the forming of the voyce, for Shearing teeth are of great consequence to true pronunciation of letters or words; and hence it is that those that want their teeth cannot so well pronounce R, S, X, Z, yea it is thought that the shearing teeth in men haue no other vse but onely for elocution although the Infant doth not lightly speake before he haue all his teeth, or at least some of all kindes. When he hath a few teeth he will mumble and as it were record, but cannot articulate plainly till he haue all, yet these shearers doe not equally assist vs in the pronunciation of all words, onely they make the prolation of some more cleare and facile. Those words that are formed of T and R cannot be pronounced without the shearing Teeth articulary, for they require that the Tongue should rest vpon the fore Teeth. *Laurentius* saith the Teeth were made for ornament, but *Homer* more wisely, that they were giuen to men to keepe their Tongues within compasse. *Bauhine* thinks that the Teeth of themselves are not onely no ornament but a fearefull sight, and therefore Nature compassed and distinguished them with Gums, couered them with the lip as it were with a buckler the better to breake and change the ingresse of the outward ayre. Those creatures who are able eyther with the hornes to defend themselves as a Bull and Cow, or with their hooves to offend their aduersaries, those creatures, I say, haue teeth onely to cate withall. They that haue saw-teeth do both mitigate their meat by them and

The number
of the Teeth.

How they
issue.

The manner of
their genera-
tion.

Their vses.

stand vpon their guard with them, for they are giuen to such creatures both to offend and to defend, whereas a man hath his hands to defend himselfe.

And thus much shall be sufficient to haue said of the Teeth, their Sockets, their Nature, Figure, Magnitude, Number, Site, Articulation, Kindes, Vessels, Sense, Cavity; and finally of their Generation and Vse.

And thus we haue brought to an end the history of the bones of the Scull and of the Face. Another bone there is which belongeth not indeed to the head, but much lesse vnto the Trunke or the ioynts, whose history we will therefore insert in this place because it is neare vnto the Head though it be not of it, and that is the bone *Hyois*.

CHAP. XIX.

Of the bone *Hyois*, called *Os gutturi*.

The bone;
Hyois.
His situation.



That bone which from the similitude it hath with the letter *v* is called *Hypsiloides*, or shorter *Hyoides*, [tab. 11, fig. 4, and 5,] is seated in the chops before the top of the Larynx, and therefore is also called by *Galen* *Os gutturi*. It lyeth like a foundation vnder the basis of the tongue, and is extended directly along the necke, and the figure of it is farre other in men then it is in brute beast. It representeth the letter *v*, for the termination thereof is not in an acute angle but in a bow or bent, and therefore is not much vlike the lower iaw, for it is not only curued like a bow as that is, but also determineth into two processes. The figure of it was thus made that the way might be left open for the meat to passe into the stomach and for the breath to passe and repasse to and from the Lungs, for as we said euen now, it is placed iust before the chops and the Larynx.

Figure.

The parts.

Although this bone be expressed by one single name yet is it not one bone but compounded of many, at least of three, at most of thirteene, but for the most part in ancient men it consisteth of eleuen bones which are ioyned together by a laxe or dissolute composition, with a gristle betweene them that they might better yeelde and giue place when they are moued.

The ends of this bone do not touch the ends of any other, and therefore it is fastened to the neighbour parts, otherwise the tongue could not haue rested vpon it as vpon her basis. The continuity therefore that the bone *Hyois* hath, is by the mediation of muscles and ligaments, for it is continued to the lower iaw about the Chin, to the brest-bone, to the shoulder-blades, to the Appendix of the Nowle called the Bodkin, to all these I say, by the kind of Coalition which we called *Synsarcosis*, for it is bound by flesh or *Flesh bound*. Of all the bones, that is the first which is in the midst, greater and broader then the rest, and as it were their basis. [14, 11, fig. 4, ABCD] On the anterior and exterior part that regardeth the mouth, it is conuex and determineth into an obtuse or dull angle, which we may feele in our selues about the Throatt although the processes do lye very deepe. This angle was made partly to secure it from outward iniuries, partly to afford an implantation to some muscles. On the inner or posterior side which regardeth the chops it is hollow, [tab. 11, fig. 4, D, fig. SP] from which hollownesse two muscles of the Tongue do arise, and beside the cavity giues way to the Epiglottis to open and lift it selfe vp.

Cavities.

It hath three bosomes; aboue, a transuerse depressed bosome [c] to admit the second paire of muscles which are proper vnto it; in the midst it buncheth out. [*] In the sides of this *Sinus* there are two other cavities, one on the right hand another on the left, which giue way vnto the first paire of muscles that are implanted into the sides of this bone.

Processes.

It hath also two processes on either hand arising out of the basis. [EFIK] which some call *Hornes* or *Ribs*, by which it is ioyned to the two lower neighbour bones.

The two lower.

The two lower which make the second and third bone [EP] do consist on either hand of one bone: they are shorter and broader then the vpper, and are fastened to the bottome of the sides of the first or middle bone [tab. 11, fig. 4, G] by the interposition of a gristle and a good broad gristly ligament. At their extremities [HH] because they are not ioyned with any other bone, they couple themselues with the processes of the shield-gristle of the throttle, and these processes together with the middle bone make the shape of the letter *v*.

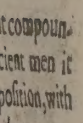
The two vpper.

But because this bone hangs like a meteor, it would not haue had sufficient strength if it had bin only ioyned with the gristle of the Larynx; nature therefore adds 2 other processes to bend it

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side, Nature hath provided muscles which ballance it and keepe it equall, and not only so, but also certaine strong Ligaments in the two sides of the bone *Hyois*, yea and others that are gristly and round which she hath inserted on each side; and as if all this were not sufficient, it is fastned by certaine mrmbranes not onely to the *Larynx* and *Epiglottis*, but to make it more stable, to the Gullet also.

The uses of
the bone *hyois*.

The uses of the bone *Hyois* are very great (though it be but a little bone) and very many. It was framed therefore for the tongue and the *Larynx*: first to be a *Basis* for the tongue above which it might be moued diuersly and suddenly, like an Eele saith *Laurentius*. The second use of it is to lift vp the *Larynx*. A third, that from it many muscles might take their originall, that is to say, some of the tongue or the fourth payre. The fourth payre from the first of the middle bone, the fift payre from the fourth and fift bone when they are there, when the fourth and fift are wanting then it ariseth from the second and third bones.

The muscles also of the *Larynx* take their originall from hence: the *anterior*, that is to say, the beginning of the first and fourth paires of the foure common muscles from the lower part of the first bone: and thus we see how the bone *Hyois* was ordayned to establish the muscles of the tongue and the throtle. And so much of the bone *Hyois*, now we proceed.

CHAP. XI.

Of the Spine in generall.

WE deuided the *Skeleton* before into three parts, the Scull, the Trunke and the Ioynts. The scull we haue prosecuted as narrowly as we could, the Trunke we also deuided into the Spine, the Chest, and the bone without a name. Vnder the name of the Spine we comprehend all that which is extended from the first Racke bone of the Necke vnto the *Coccyx* or Rump: and this the Grecians call *σπονδυλός*, because the backpart of it is sharpe and spinie. It is called also *dorsum* or the Backe, because the Backe is the greatest part thereof.

What the
Spine is.
The dignity
thereof.

This Spine is the habitation or seat and defence of the Marrow as the Scull is of the Braine. For because the dignity or worth of the Marrow of the Spine is equall to the worth of the braine (for it is the originall of all the sinewes excepting seuen coniugations, and therefore is called the Braines Vicar or Substitute) Nature was no lesse carefull of the preservation thereof then she was of the Braine it selfe. As therefore the Braine was compassed with the bones of the Scull as with a Helmet, so the Spinall Marrow is walled in on every side by the Racke bones of the Chin.

Why the spine
is hollow.

This that nature might the better accomplish, first she hollowed the spine throughout, then she exasperated it with many processes both acute and transuerse, thereby as it were flanking the bulwarke against all annoyanc. The cavity is large, the better to containe the Marrow, in which respect the whole Spine is called *σπονδυλός*, the *Sacred Pipe*, by *Herophilus* the Canale. The Spine therefore is bony, not made of one but of many compacted together, as wel to helpe the variety of motions because it was fit the creature should moue forward and backward, as also to preuent danger; for the luxation, saith *Hippocrates*, of one Rack-bone is more dangerous then of many, because it constraineth the Marrow into an acute angle, and so doth necessarily either breake it or compresse it very sore.

Why made of
many bones.

These bones that make the Spine are called *σπονδυλοι*, from the similitude they haue with the whirle of a wheele. They are also called *vertebrae*, because by them the body is turned into diuers parts. *Pliny* calls them *ossa orbiculata* round or *Nut-bones*. This Spine is the *Basis* and foundation of the whole building, and therefore the ancients compared it to the carkasse of a Ship, for as the crooked ribbes and elbowes of a Ship are fastned to the bulke, and afterward the prow and the sterne or fore-castle are annexed, right so the ribs, the Armes, and the Legs are fastned to the Spine.

The figure of
them.

The figure of the Spine *Hippocrates* first elegantly expressed in the third Section of his Booke *de articulis*, and in his Booke *de natura ossium*, where he saith it is *ῥησχαλός*, that is, after a manner direct or straight; yet so that it inclineth sometime backward sometime inward. From the first Rack-bone of the Necke vnto the seuenth it inclineth inward that it might support the Gullet and the rough artery. From the first Racke of the Backe vnto the twelfth it beareth outward, to leane more space for the organs of Respiration, that is, for the Heart and the Lungs. The Loynes incline inward to support the descending trunks

trunkes of the hollow veine and the great artery. The holy-bone protuberateth outward with a kinde of rectitude or streightnesse to make the capacity of the *Hypogastrium* or water-course better able to containe the bladder, the right gut and the wombe.

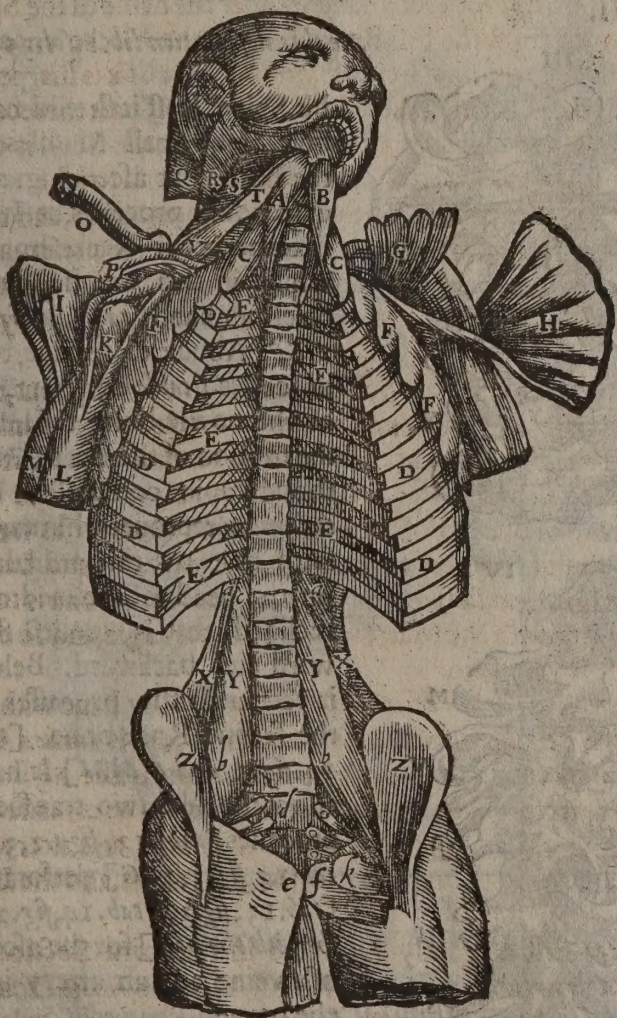
We also will adde, saith *Laurentius*, that the fore and inner part is equall that it might not offend the bowels, yet scored throughout with transverse inscriptions: the backside is vnequall for the better insertion of muscles, and the safer egress of the vessels.

The Spine may bee deuided into foure parts, the Necke, the Backe, the Loines, and the Holy-bone. The Rackes of the necke are seuen, of the backe twelue, of the Loines sine, whose articulation and coalition is strange and wonderfull. The articulation is double, forward and backward; forward articulation is made by the bodies of the Spondels, and is more strict and close: the backward or hinder articulation is made by the oblique processes and is more lax or remisse, partly that the creature might moue more easily forward, partly least in bending backward the vessels should be distended, compressed, or broken. In a word, there are fixe articulations of the rackbones, two by their bodies, and foure by their oblique processes ascending and descending. That articulation which is made by the processes belongeth to *Ginglymos*, for euery racke (excepting the first and the eleuenth) receiuerh an vpper and is receiued by a lower, so that for the making of the *Ginglymos* there must be three rackebones.

The *Symphysis* or coalition of the Rack-bones is not *Gristle bound*, although their extremities be lined ouer with a gristle, but by Ligaments and those very strong, arising from the bones, from the gristles, and from the membranes that inuest the bones.

TABVLA XII.

See this Tables description, in fol. 771.



All the racke-bones of the Spine haue many things in common. First euery racke hath his body seated on the inside thicker and more fungous then the rest of the bone, to which also Appendices do grow and gristles. It is broad both in the vpper and in the lower basis to make the articulation more secure least it should lux sideward. Againe, euery rack hath a large hole wherein the marrow is contained, and this perforation is in all the rackes equall, saith *Laurentius*; for hee neuer could obserue it larger above or narrower below, although some haue thought the contrary. But, saith *Laurentius*, although the wonderfull fruitfulness of the marrow of the backe in propagating Nerues be by degrees diminished, yet those lower cauities are filled vp with thicker Membranes, prepared more straitly to vnite the thicker bodies of the Spondels. Thirdly, in euery rackbone there are three kinds of processes, oblique, transverse and acute. The oblique are foure, two in the vpper part and as many in the lower; the vpper ascending, the lower descending,

and by these are the Hinges of the backe hung together, for the articulation is made by *Ginglymos*.

The transverse processes are two, made to secure their muscles and for their originalls and insertions. The acute processe is single, seated in the backpart, and giueth the name vnto

Foure parts of the Spine.

The Articulation of the Rackes.

What the rack bones haue in common.

into the whole, for it is called *Spina*, or the *Spine*, and this is wanting onely in the first Racke.

Fourthly, in euery Rack-bone there are five Appendices, two in the body, two in the transuerse processes, and one in the Spine.

Finally, euery spondell which is articulated with another, hath a perforation which affordeth an outlet for the nerves, produced from the Marrow. Notwithstanding this perforation is not after the same manner in all the Racks, for in those of the Necke the lower is deeper then the vpper: in the spondels of the Backe, the semicircle of the vpper and the lower is equall: in the *vertebra* of the Loynes the whole cavity almost is formed by the vpper. And these things are common to all the Rack-bones. Now in their particular history we shall see what is proper to euery one of them; but first you shall haue a Table or two to shew you all the Rack-bones of the Spine from the top to the bottome, as the twelfth and the foureteenth.

CHAP. XI.

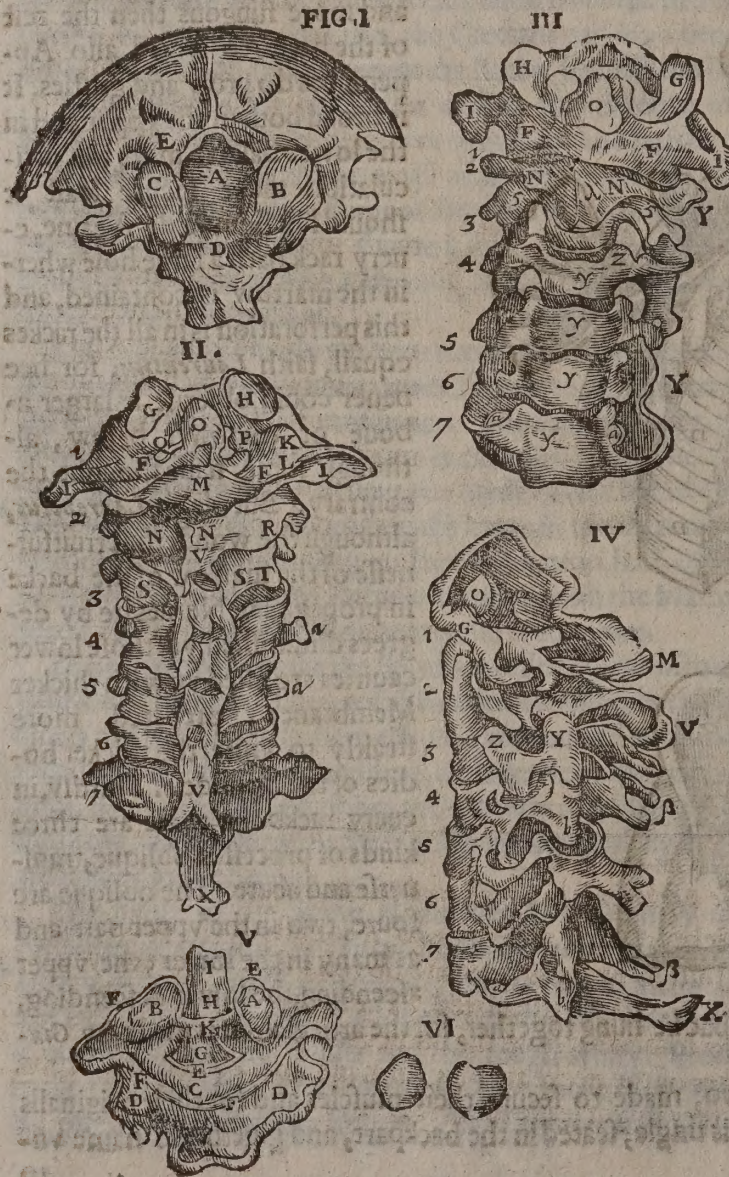
Of the Rack-bones of the Necke.

THe vse of the whole Neck and his admirable structure doth not belong to this place, and of it we haue spoken before: here we haue to do onely with the Bones, which are commonly seuen [*ta. 13, fig. 2, 3, 4*] differing both amongst themselves and from the other Racks of the Spine.

The two first are ioyned to the nowle by Ligaments, whereby the head is strongly fastned to the necke. The first of these [*ta. 13, fig. 2, 3, 4, FF ta. 14, fig. 2, 3, 4*] is called *Atlas*, because as he was imagined to hold Heauen vpon his shoulders, so this especially beareth h vp the Head. The body of it is more slender but faster then the rest, and it wanteth his vpper processe or

TABVLA. XIII.

See this description lib. 6. fol. 397,



his Spine, least it should haue hurt two small Muscles of the head: but ascending and descending processes it hath like the other Racke-bones, which in this are hollowed on either hand [*table 14, fig. 2, 2.EF*] Aboue to receiue two processes [*table 13, fig. 1, B C*] of the nowle-bone to helpe the motion of the head (*Galen* thought) in compasse, but *Columbus* reprobeth him who saith that by this articulation the head is inclined and reclined, that is, moued forward and backward. Below it receiueth the processes of the second Rack-bone. [*tab. 14, fig. 5, and 6, MM*] It hath also at the sides two transuerse processes [*tabl. 13, fig. 2, 3, II* *tab. 14, fig. 3, 4 GG*] perforated [*tab. 13, fig. 2, K* *tab. 14, fig. 2, H* sheweth the hole] for the ascent of a veine and an artery into the brane.

It hath also a *sinus* or bosome [*ta. 14, fig. 2, 3, B*] crusted ouer with a gristle [*fig. 3, 4, E*] the better to receiue the tooth [*fig. 7, O*] of the second racke,

Seuen Rackes
of the Necke.
I. Atlas.

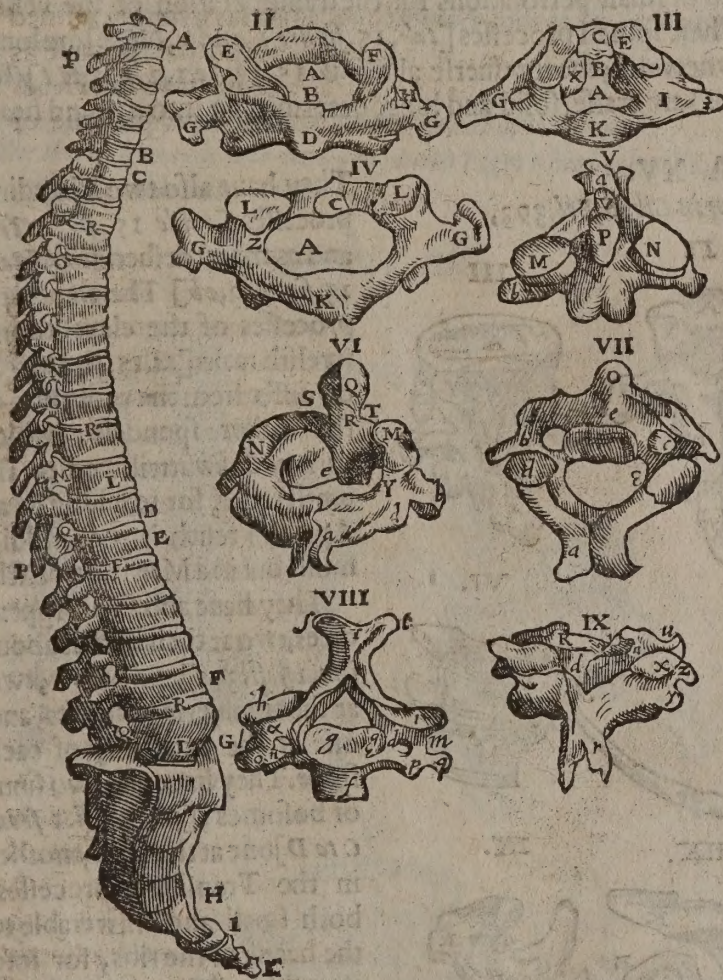
The first Racke, and at the processes where the racks are ioyned there is a sinus on either hand: in the first [fig. 4, Z] and the second [fig. 6, r] bearing the forme of a rift or cleft, in the other racks it is orbicular, saving that in the chest it is somewhat long. Through these sinus are conveyed coniugations of sinewes and branches of Veynes and Arteries, ministering nourishment to the marrow and to the bones.

The second Racke [tab. 13, fig. 2, 3, N tab. 14, fig. 5, 6, 7] besides his body, his laterall processes [tab. 14, fig. 5, 6, 7 b] short and perforated with an oblique hole, [fig. 7, c] his Posterior proccesse byfurcated in respect of the muscles, [fig. 5, 6, 7 a] his ascending processes lightly bunching out, and his descending [tab. 13, fig. 2, K, tab. 14, fig. 6, 7 d] lightly sinuated: beside all these, I say, there yssueth out of the middle of his body an appendix (commonly called a proccesse) round and long, [tab. 13, fig. 2, 3, 4 O, tab. 14, fig. 6, Q, fig. 7 O] which because it is like the Dog-tooth of a man, is called the Tooth. Hippocrates calleth the whole Racke the tooth, and in the luxation thereof, saith he, happeneth the most incurable Squinsery. This Appendix is somewhat rough in the surface, that from thence a Ligament might yssue [table 13, fig. 5, f] by which it is fastened to the Nowle; about it also is cast a solid and round [tab. 13, fig. 5, K] ligament to keepe the marrow from compression. More over this second racke is ioyned to the first by a broad Ligament [tab. 14, fig. 5, F] which is orbicularly cast round about it.

TABVLA. XIII.

See this Tables description, in lib. 6, fol. 398.

FIG. I



The third Racke-bone [tab. 13, fig. 2, 3, SS, tab. 14, fig. 8, and 9] is called *axis*. It is ioyned most strictly and exceeding firmly on the outside to the other 2. The third, as also the three following, have their laterall processes byfurcated, [tab. 13, fig. 2, V, V, fig. 4 b] for the better implantation of the Muscles; but the sequent [tab. 13, fig. 1, 2, 3, 4, cha. 7] agreeth with the racks of the Chests, and his posterior proccesse is not alwayes byfurcated [tab. 13, fig. 24, X] but whole and sound: his body below is plaine, that it might equally be ioyned to that which followeth. Finally, all the racks of the necke excepting the first have Appendices, betwixt which doe runne thicke and soft Gristles for their more facile motion. And so much shal suffice to haue spoken of the rack-bones of the necke; for concerning the motions of the head, we haue spoken before in the Booke of Muscles.

CHAP. XXII.

Of the Racks of the Backe and the Loynes and the Holy-bone.



The backe is called in Greeke *πλάγος*, in Latine *tergum*, it consisteth of twelue racke-bones, [tab. 14, fig. 1 at D] iust so many as there are ribs on a side, for to euery rack-bone are two ribs [tab. 15, fig. 5, D P] articulated. The bodies of these Racks as also their processes do differ somewhat from the bodies and processes of the racks of the Necke. The bodies of the racks of the necke are long, broad and equall, that vpon them the Gullet and the Rough Artery might leane more securely.

How the racks of the necke and the backe differ,

The

The bodies of the rack-bones of the backe are round, convex or embowed, thicker also and not so solid. The spinall processes of the necke are byfuted, those of the backe are long, simple and do bend downward. The transuerse processes of the necke are broad and perforated. Of the backe, thick, solid and round, to make the articulation of the ribs more firme, excepting the eleventh and the twelfth, to which the last and the shortest ribs are fastned, that there might be more space left for the Liver, the Spleene, and the parts thereunder.

Of the twelve Rackbones of the backe, sometimes (but rarely) there is one wanting, more rarely is there one too many, yet for the most part dogs haue one more then men. They were made many for the better flexion of the spine, and are fastned together with strong ligaments, [tab. 14. fig. 1 RR. 14. 15. fig. 6 ch. 5] yet there is a good quantity of gristle betwixt each of them. [tab. 15. fig. 6. char. 1, 2]

The first.

The first racks of the backe is called by the Ancients *λοφία*, because it standeth out beyond the rest, the second is called *μωσχλησις*, that is, the Axillary spondell: the eight following *πλευρίται*, that is, *Costales* belonging to the ribs. The eleventh [tab. 15. fig. 3] is called *ἀππεμία*, because his spine is right, and this like a naile fasteneth the other racks. *Laurentius* addeth, that it is quite contrary to the first; for the first receiueh and is not received, this eleventh is received but doth not receive. The twelfth is called [tab. 15. fig. 4] *δισζωσις*, the compassing spondell.

Their figures.

These Racke-bones haue in the middle protuberating, round and embowed bodies, [tab. 15. fig. 1] above and below [tab. 15. fig. 1, 2, 3, 5, A] plaine, thicker then the Racks of the necke and lesse solid; full also of small perforations for the transportation of the vessels that carry the nourishment. Their spinall processes [tab. 15. figure 1, and 2, NOP] are long, simple and accure looking downward; the transuerse also [tab. 15. figure 1, 2, 3, 4, HI] (for the firmer articulation of the Ribs) are crasse, solid and long, determining into a round head.

TABVLA XV.

See this Tables description in Lib. 6. Fol. 393.



descend, and so the holes of the lower racke-bones become straiter. And so much of the backe.

The

They haue also two ascending processes [table 15. fig. 1. TV] and as many descending. [tab. 15. fig. 2, 3, 4b] The transuerse processes of the eleventh and twelfth racks [ta. 15. fig. 4. efgb] do differ from the processes of the other spondels, which variety *Galen* attributed to the tenth racke, for in a Dog or an Ape the tenth is the middlemost, but in a Man the twelfth.

They haue also five Appendices, two at their bodies above [ta. 15. fi. 3, 4] and below; two at the transuerse processes, and one at the extremity of each spine. They haue also two sinus or bosomes; [tab. 15. fi. 1 from C to D] one at the sides, another in the Transuerse processes, both small and answerable to the heads of the ribs, for into them the ribs are articulated. The holes of these Rack-bones [ta. 15. fi. 2, 3, 4 G] are proportionable to the marrow which they containe, and though *Laurentius* will not agree thereto, *Bauhine* conceiueh that the marrow is attenuated in the

The Loynes make the third part of the spine, and doe consist of five Spondels [ta. 16, fig. 12, from b to c] the greatest and thickest of all the rest which are fastned by Gristles and thicke Ligaments; above, with the racks of the Chest or the backe, [tab. 16, fig. 2, a, sheweth the last racke of the backe] below, with the Holy-bone, [tab. 16, fig. 1 and 2 c] for they lye vpon them, and are articulated by the interposition of a Ligamentall gristle; yet so, that the motion of the Loynes is more lax and dissolute then that of the backe: the Reason was, because wee might better incline our selues vnto the earth.

The first Racke of the Loynes is called *νεφρίτις*, from the Kidney which resteth it selfe vpon it. The last is called by some *ασφαλής*, that is, the supporter or the strengthner.

The Rackes of the Loynes, beside their laterall perforations made for the transmission of the Nerves, are also thrilled through with small holes.

Their processes are Ascending. [tab. 16, fig. 4, and 5] Descending [fig. 4, N] and transuerse, [fig. 2 cc ff. 3, 4, 5] longer and slenderer then in the rest: but their acute processes which they call the Spine [tab. 16, ff. 3, 4, 5 C D] are thicker then in the rest and broader, that to them the Ligaments and muscles of the backe might be fastened. The Spondels also of the Loynes (saith *Laurentius*) haue processes like a Medlar stone, which is found sometimes in them all, sometimes onely in the vppermost. And so much of the Loynes.

The Holy-bone, called *Os sacrum* and *ισχυν*, not because it containeth in it any sacred and hidden mystery, as some haue fondly imagined, but because of his greatnesse, for it

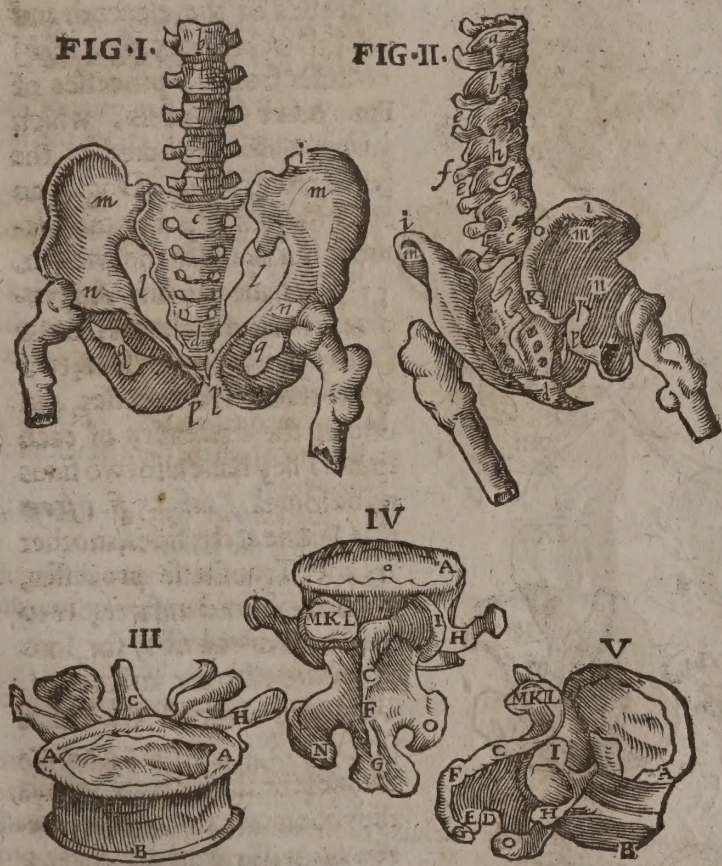
Table 16, figure 1, sheweth the anterior part of the bones of the lower belly.

Fig. 2. The posterior part.

Fig. 3, 4 and 5, do shew one of the Rackbones of the Loynes.

The third figure his fore-part, the fourth Figure his backpart, the fifth figure his side.

TABVLA XVI.



other side. O, 4, 5. The head of that descending proceffe.

is the greatest of all the bones of the Spine: So *Homer* calleth great Fishes *Pisces sacros*; and *Hippocrates* for the same reason calleth this Holy-bone *vertebram magnam* the Great racke-

2. The last rack-bone of the spine. From b to c 1, 2. The five rackbones of the Loynes or of the Rheynes. From c to d, 1, 2. The broad Holy-bone. d 1, 2. The hip bone or the *Coccyx*.

ee 1, 2. The laterall processes.

f, 2. His posterior proceffe or the Spine.

g, 2. The vpper proceffe.

h, 2, the lower.

ii, 1, 2. The plainer or bunching part of the *Coxa*.

k, 2, His lowest proceffe.

ll, 1, 2. A bosome or cavity in the lower part of that bone.

mm 1, 2. The hanchbone called *Os Ilium* and *Lumbare*.

nn 1, 2, the sharebone *Os pubis*.

qq. 1, the hole of the share-bone.

AA. 3, 4, 5. The vpper appendix of the body of the racke.

B, 3, 4. The lower Appendix.

C, 3, 4, 5. The vpper part of the spine of the racke of the Loynes, or a broad and rough line.

D, 5 the lower seat of this spine or the lower line.

E 5, A sinus or cavity at the side of the line D.

F, G, 4, 5. The appendix of the spine resembling a triangle.

H 3, 4, 5. A transuerse proceffe on either side.

I, 4. The right ascending proceffe.

K, A sinus of the left ascending proceffe.

L, M, 4, 5. the browes of this sinus before and behinde.

N 4. The descending proceffe of the

rack-bone. It is also called *man*, the broad bone. The figure of it is almost triangular, having a broad beginning, and ending by degrees into a narrowness. Immoveable it is and maketh the *Basis* of the backe. *Galen* saith it consisteth of three bones, by which he vnderstandeth the three first, but the truth is, that it is made of five bones [tab. 16, fig. 1. and 2, from c to d tab. 17, fig. 6, from A to F] as it were of proper racks knit and fastned together by gristles, which in growne bodies are so fast glewed that it seemeth to be but one bone, whereas in children the gristles betwixt the bones are very euident.

This Holy-bone on the foreside is hollow, smooth and equall: behind it is incurved or gibbous, rough also because of the Ligaments and the muscles of the backe. His acute processes are very small, the transuerse [tab. 17, fig. 6, and 7, K] but obscure, and determining into a cavity shallow, vnequall and rough, which receive the hanch-bones ascending processes, onely the first racke of the Holybone is allowed [tab. 17, fig. 6, 7, S] by which it is articulated with the descending processes of the last spondels of the Loynes. In the sides of the three vpper bones there are certaine *Sinns* or bosses insculped, to which the hanch-bones doe so cleave and are articulated [tab. 17, fig. 7, M] that they seeme to grow together.

It hath also Spines [tab. 17, fig. 7, dddd] looking downward, which in the fift and sixt bones are diuided into two parts. The perforations of this Holy-bone [tab. 17, fig. 6, and 7. char. 1, 2, 3, 4, 5, 6, shew the holes of the nerues; fig. 7, efgbik shew the holes for the marrow] are before and behind, not on the sides as in the other Rack-bones, because the hanches do occupy them, and the anterior are greater then the posterior, because greater nerues are distributed in to the foreparts and into the hind parts.

At the end of the Holy-bone appeareth the Rump-bone called *Os Coccygi*, [table. 16.

TABVLA XVII.

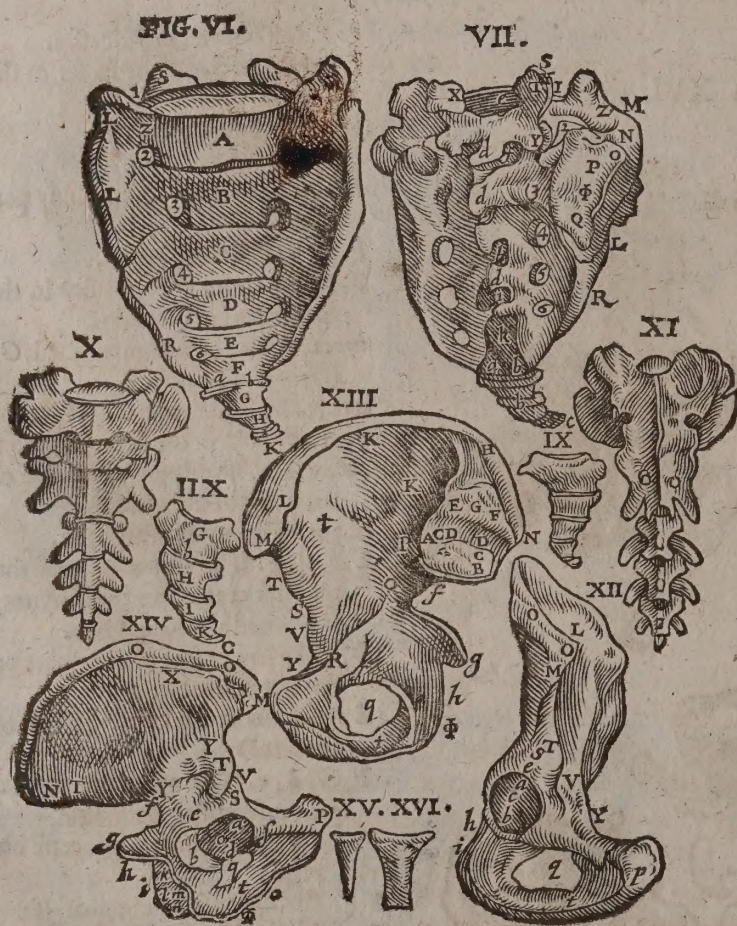


Table 17. Fig. 6, sheweth the fore-side of the Holy-bone and the Rump. Fig. 7, the back-side. Fig. 8, the Rump-bone of a man curved forward. Fig. 9, the Rump-bone of a woman curved backward. Fig. 10, sheweth the fore-side of the Holy and Rump-bones of an Ape. Fig. 11, their back-side.

From A to F 6. The fixe parts of the Holy bone placed vnder the fift racke of the Loynes.

From G to K 6, 8, foure bones of the Coccyx or rumpe which cleave to the Holy bone.

LL 6, 7, The large transuerse processe of the second Holy-bone, for the rest as farre as R, are by degrees angustated or strayned.

M 7, an vnequal bone of the Holy bone to which the right hanch bone is ioyned.

N 7, the exterior part of this *sinus* which is the plainer.

O 7, a long protuberacion distinguishing this exterior *sinus* from the interior, noted with Φ .

Φ 7 the interior *sinus* vnequall.

P Q 7, the vpper and lower part of this *sinus*.

R 6, 7, a swelling of the transuerse processes whereto a ligament is ioyned.

S 6, 7, The ascending processe of the first bone. T 7, a *sinus* of the processe receiuing the head of the descending processe of the fift racke of the Loynes. V X 7, the browes of this *sinus* on either hand. Y 7, The connexion of the descending processes of the first bone, with the ascending processes of the second bone. Z 6, 7, the coniaction of the transuerse processes of the first and second bones. ab 7, the connexion of the Holy-bone with the Rump. bb 6, 7, 8, a gristly ligament coming between the loose connexion of the Rump bones. c 7, 8, a gristle growing to the end of the Rump bone, dddd 7, the spines of the Holy-bone. efgbik 7, Holes betwixt the distances of the spines made for the transmission of the spinal marrow. 1, 2, 3, 4, 5, 6, in fig. 6, and 7, holes through which the Nerues of the Holy-bone doe passe.

fig.

Fi. 1, and 2. d. 17. f. 8, and 9.] because it is like a Cuckoos beake. *Galen* calleth it an *Appendix*, and vnder that name vnderstood the three lower bones that belong to the Holy-bone.

This Rumppe consisteth of three or foure bones [*tab. 17. fig. 6. and 8. from G to K*] and two gristles. One where it is fastned but loosely to the Holy-bone [*tab. 17. fig. 6, and 7.*] that it might yeeld backward when the thicker excrements are auoyded, and when we sit downe, returne forward into his place. In men it is curued or bent more inward to sustaine the right gut, but in women outward, because of the necke of the wombe. The second gristle is at the very extremity or end of it, [*ta. 17. fig. 3, and 7. c*] sometimes also it is placed betwixt his first and second bones.

That this Rumppe-bone in the time of the birth is retracted or drawne backward, we doe no more doubt saith *Laurentius* then we thinke it impossible that at that time the sharebones should be disioyned. And thus haue we brought to an end the History of the Spine which we made the first part of the Trunke. Now we proceed vnto the Chest.

CHAP. XXIII.

Of the Bones of the Chest in generall.



HE second part of the Trunke is called *Thorax*, a word which signifieth to leape, for the heart therein contained is moved with perpetuall subsultation. Wherefore because it containeth so noble a bowell, so necessary for the maintenance of life, therefore Nature hath defended it with bones. But againe because in Respiration it must continually be distended and contracted, therefore it was made also partly fleshy. The fleshy part we haue described in his proper places, that is to say, in the sixt and tenth bookes. The bony part though we haue touched vpon before in the sixt booke, yet because it pertained properly to this place, we will attend it here more distriktly.

The Chest therefore is circumscribed or bounded out, aboue by the clauicles, below by the Brest blade. But more precisely his parts are *anterior* or *posterior* or *laterall*. The *anterior* part is called *σθηνον*, *Sternum* the Brest bone: the sides *πλευραι*, *coste* the Ribs: the *posterior* part *ρῶν*, *dorsum* the Backe, whose vpper sides are called *ωμωπλάται* and *πτερύγια*, the Wings or the Shoulder blades, and all these we will describe in their order.

The diuision
of the bones of
the Chest;

CHAP. XXIII.

Of the Clauicles or Colter Bones.



HE Cavicles are called by *Galen* *κλειςίδες*, because they close or shut vp the whole Chest, or because they conclude the Arme and the Necke. *Celsus* calleth the place *Inguhum a iungendo*, of coupling, because it couples the Brest bone with the Shoulder blade and the Arme, for these two bones are very like the yoke wherein two Oxen do draw together: but by the name *Inguhum* we commonly vnderstand the hollow place aboue the clauicles where they vse to sticke a Swine. These Clauicles Nature hath giuen to no other creature sauing to a Man, an Ape, a Squirrell, a Mouse and a Hedge-hog. There are two, one on each side, seated ouerthwart in the bottome of the necke and top of the brest-bone. Their figure is not streight, but at the *Inguhum* embowed outward, [*ta. 18. fi. 2, H*] on the inside they are concauous or as it were guttered. At the shoulder-blade on the contrary they are lightly hollowed on the outside, but on the inside conuex or embowed. [*ta. 18. fig. 1, 2, 3*] In men they are not so crooked as in Apes; and therefore are most like the Latine S, but in Apes more like the S. They were made hollow on the fore side where they regard the *Inguhum*, that the vessels which run vpward, that is to say, the *Inguhum* veines and the sleepey arteries might not be compressed; but especially because of the propagation of sinewes, which from the marrow of the backe run vnto the arme-holes. They haue in them a double semicircle for more strength, for if they had been simply semicircular being fistulated and spongy within, and but as it were crusted ouer with a thin bony scale, they might easily haue broken, yea and are notwithstanding. Though these bone be long, crasse and crooked, yet they are more crooked in men then in women, that the motion of a mans arme might be at better command; but in women [*ta. 18. fi. 4, R*] they are lesse curued and arise higher: hence it is that women are so awkward when they throw a stone or strike a bal, but nature made recompence, for her neck is so much the more beautifull and statelie built, because there is no such hollownesse in it as in a mans.

Their names;

Their figure;

How they
differ in men
and women.
Their protuberations;

Rrrr

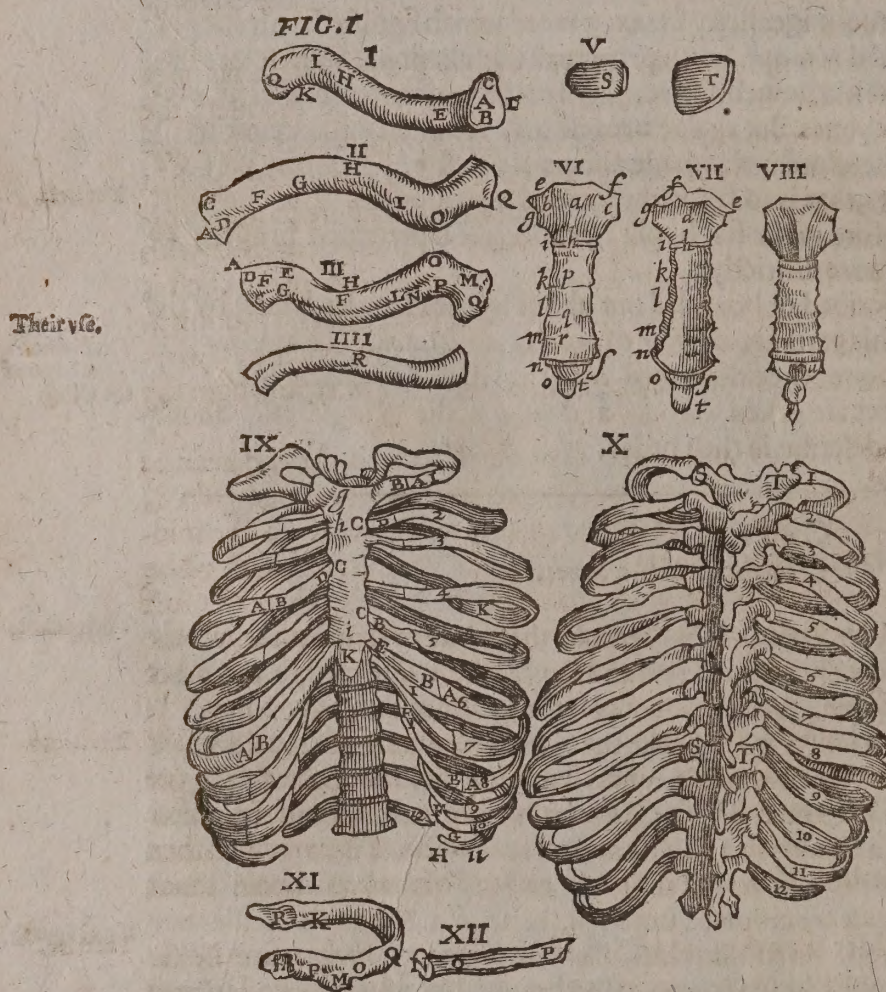
They

They bunch something forward, and haue two rising lines in them [tab. 18. fig. 1, 3, E fig. 2 FG] from which the *subclavian* muscle and a part of the pectorall muscle doe arise. They haue also a knob or protuberation from whence ariseth a Ligament which goeth to the inner proceffe of the shoulder-blade, [tab. 18. fig. 3, it ariseth about N] Neere their ends they are also on both sides exasperated, and from that roughnesse proceede Ligaments, and the muscle called *Mastoides* or the seventh of the head. But where the Clavicle is broad, there it affoordeth an originall to the muscle *Deltoids*, and an insertion to the second muscle of the bladder.

These Coller-bones fasten on both hands the shoulder blades with the brest-bone by *articulation*, yet there commeth betwixt them a large gristle [tab. 18. fig. 5 ST] which is moistened with an Oyly humor. And this gristle is called *κατακλῆς*, *clausura*, because it closeth them together, yet doth it not grow vnder them, but is onely held downe by the Ligaments that compasseth the ioynt, that in the motions of the arme and the shoulder it might giue a little way.

TABVLA. XVIII.

See this Tables description in lib. 6. fol. 393.



the opposite side: and when it is voluntarily bent or with violence moued that way, might yet be able to recouer it selfe, or to stay his fall; therefore the clauicles were set betwixt the two sides to inhibite or preuent any such ouer-extent or downe fall: againe, were it not for the Clauicles when we offer to thrust any thing strongly backe-ward, the blade would fall forward, as sometimes the arme falls vpon the ribs when it is luxed or put out of ioynt, or when the blade hangs downe like a wing, as it will do when the Coller-bone is broken. And thus much concerning the Clauicles.

It hath two heads, one smaller, cruisted over with a gristle, [tab. 18. fig. 1, 2, 3, 4] whereby it is ioynted to the brest-bone as we said: the other is broad and somewhat long [ta. 18. fig. 1, 2, 3, 2] by which it is articulated to the vpper proceffe of the shoulder-blade by the interposition of a peculiar gristle, which *Galen* calleth the small gristly bone, made, saith he, for the security of the ioynt.

The vse of the Coller-bone is, that the Blade should not together with the Arme fall vpon the breast, and so many motions of the arme bee forfeited. It is true indeed that these bones may seeme not to belong vnto the Chest, because all brute beasts haue Chests, but very few of them these bones. We answer, that Nature is most Wise in her administrations and hath therefore giuen these bones vnto men because they haue hands, which it concerned them much diuersly to moue into many positions from one side to another. Now because in such flexions the arme should not fall hedlong as it were into

CHAP. XXV.
Of the Brest bone.

The Brest-bone is the forepart of the Chest, and called in Greeke *σέπρον*, either because [ta. 18, fig. 9, g h i] it is disposed in the middle of the ribs, or because there is *σέπρον τῆς ψῆς*, *Mentis firmitas*, because the heart lyeth vnder it. Hippocrates calleth it *σῆθρον*, the Latines *Pectus* or *os pectoris*, the brest bone, because it maketh the forepart of the brest, and safeguardeth the noble parts therein contained. This Brest-bone is somewhat conuexe or embowed, long also or broad, and because it is like the handle of a dagger such as was vsed in old time, it is called *εὐποειδής*. The substance of this bone is not solid as other Bones are but fungous and reddish, compounded also of Bones and Gristles; for it is not one bone, vnlesse it be in very old men, otherwise if you scrape off the membranes, you may see it is compacted of many. In Infants new borne it is altogether gristly excepting the first bone of it, a little after there may be obserued eight distinct parts, each of them distinguished from other by a large and thicke Gristle, seuen of which were made to receiue the articulation of the seuen true ribs. The eight was framed to be a foundation to the Sword-like Cartilage, which we properly call the Brest-blade.

These bones after seuen yeares are conioyned and begin to grow fewer, yet sometimes foure may be distinguished, that is to say, the first [ta. 18, fig. 6 a] which is the broadest, the second and the last: those betwixt these do grow into one; but in growne bodies there are but three, distinguished each from other by a transuerse line. The first and the last both in young and old are alwayes one, but the middlemost is distinguished into many parts, according to the youth and age of the party, which parts are *gristle-bound* or fastened together with a gristle betwixt them by *Coalition*. For although according to the motion of the chest it seeme to be eleuated and againe depressed by the helpe of the ribs, yet it hath no motion apart or by it selfe. In dogs it consisteth alwayes of seuen Bones ioyned together by *Synarthrosis* or *Coarticulation*. But we will follow the description as it is in a man, in whom the Bones are three.

The vppermost [ta. 18, fig. 6 abc] is larger and thicker then the rest, and is like the head or pummell of the handle of a dagger, but flat and vnequall; horned or crescent about [ta. 18, fig. 9, g] which maketh a kinde of cavity or den which some haue called *Iugulum*. In the midst for more strength it protuberateth like a triangle [ta. 18, fig. 6, a] at which the first ribbe [fig. 6 g] is ioyned; a gristle comming betwixt them. A second gristle it hath, where the first bone is ioyned to the second. [ta. 18, fig. 6 b] On the inside about the midst it hath a bosome grauen in it [ta. 18, fig. 7, d] made to giue way to the descent of the rough Artery, and other bosomes on each side [ta. 18, fig. 6 and 7 e f] which receive the heads of the collar bones.

The second Bone of the *Sternum* hath on either hand in the sides many cavities [ta. 18, fig. 6 klmn] distant one from another vnequally, & it is compared not amisse to the haft of a dagger wherein there are inequalities for the fingers to take fast hold vpon, for euen so these impressions do receiue the gristles of the third, fourth, fift and sixt ribs. This Bone is narrower then the other two, and in women sometimes toward the end perforated with a broad hole much like a heart, [ta. 18, fig. 8 u]

The third Bone is lesse but broader then the second [ta. 18, fig. 6, and 7 f] wherefore *Celsus* wrote that the Brest-bone was horned or crescent at both ends; but you must vnderstand him of a man and not of a dog. Hereto is ioyned the gristle of the seuenth rib iust where it selfe is fastened vnto the second bone, and in some bodies it is diuided in the midst by a line.

On both sides this *Sternum* is smooth, sauing that about it is somewhat exasperated to giue an originall vnto the muscle *Mastoides* or the seuenth muscle of the head. Gristles it hath, (beside the two vpper which goe betweene the coniunction of it with the Clauicles) one betwixt the first and the second bone [tab. 18, fig. 6, 7 b] which supplieth the place or doth the office of a Ligament. Another in the end, long, moueable, and triangular [table 18, fig. 6 and 7, e] which commonly is sharpned like the poynt of a sword, whence it is called *εὐποειδής*, *Ensiformis* and *Mucronata*, the *Blade of the Brest*; this also is sometime broad in the end, sometime byfurcated, and therefore some haue called it *Furcella*, the *little forke*. Oftentimes it is round, sometimes double, saith *Laurentius*, and the lesser part lyeth vpon the greater, as the leaues of the Herbe called *Horsetounge*: sometime also it is perforated

The names

Substance

Number of the Bones.

The first

The second

The third

The Gristles of the brest-bone

ted [tab. 18, p. 8 u] to transmit the Mammary veines which are accompanied with a nerue. If this gristle (saith *Platerus*, and *Baehne* consenteth with him) be too much pressed or curued inward in children, which disease women call the *Compression of the Heart*, it offendeth the Liuer and the stomacke vnder it, and those children dye of that kinde of consumption which we call an *Atrophie*, for in children this gristle is somewhat long, and oftentimes may be felt with the finger. Heere also we must obserue that cavity which the Ancients call *xapdia*, commonly the *Heart-spoone*. The whole brest in men is somewhat eleuated or raised vp, but in women it is more flat and depressed because they haue greater dugs which would stand out too far if the brestbone were raised as high as it is in men.

The vse of the brest bone is the same which we shall say anon the vse of the ribs is. The Brest-blade is a defence to the parts thereunder, that is, the Midriffe and the mouth of the Stomacke; and this may be proued, saith *Baehne*, because if it be compressed or rubbed too much, a *Nausea* or loathing will follow: againe, he that is ready to vomit shall finde a paine iust vnder it. And thus much of the Brest-bone.

CHAP. XXVI.

Of the Ribs.

The Names
and Number.



THE sides of the Chest are called by the Grecians *μεσος*, and *σώμα*, because they are placed side by side like the Rowers in a Galley: the Latines call them *Costae*, we call them the Ribs. They are commonly both in Men & in women on each side twelue, oftner more then fewer. For nature would rather there should be abundance then want. And in a publicke Anatomy when a Malefactor was cut vp, *Baehne* found thirteen on each side: the first on the left side was perfect, but the first on the right side was imperfect.

The true ribs.

Falopius also twice found one too many, *Columbus* once eleuen at *Padua*. They are diuided in to True and Bastard Ribs. The true Ribs are the seven vppermost [ta. 18, fig. 9, from char. 1 to 8] so called, because they make a perfect circle being ioyned together by the Spondels of the Back and the Brest-bone. For behind they are fastened with strong Ligaments by *Dearticulation* or *Diarthrosis* to the Spondels of the backe. [ta. 18, fig. 10, ST] And that they might sticke the closer the knot is double, one higher at the body of the Spondell, another lower at his laterall process: Before, they are articulated to the brest-bone, [ta. 18, fi. 9, c] for their Cartilages be like little heads ioyning with the smooth bosomes of the *sternon* by *Synarthrosis* or coarticulation. The two first Ribs are called *ἀντιστοιχοί*, as it were *Retorted*, the two next are called *σπερδι*, that is, *solid*; the three last, by *Pollux* (he that gaue them all Names) *σπεινιδες*, that is, *Pectorall* Ribs.

The bastard ribs.

The Bastard Ribs are the five lower; they are soft and almost gristly, that themselves might be more safe from iniuries, and by them the parts thereunder. And indeed, the prominent parts of bones were for the most part by Nature made gristles, for a gristle if it be wounded or violated will not breake but easily reunite. These Bastard ribs therefore do end into exquisite gristles, which are retorted vpperward and fastned one to another [ta. 18, fig. 19 FF] excepting the twelfth, and so are ioyned to the gristles of the true ribs; [ta. 18, fi. 19, I]

They may also be said to be imperfect, because they are onely articulated vnto the Racke-bones, but that after diuers manners. For the eight and the ninth haue a double articulation, yet doe their ioynts not sticke out so farre as the ioynts of the true Ribs doe, which receiue more strength from the Rack-bones then from the Brest-bone. The eleuenth and the twelfth haue onely the vpper articulation, as also hath the first oftentimes, but the tenth is ioyned sometimes with a double ioynt, sometimes with a single.

These Bastard ribs do not attaine vnto the Brest-bone, that the lower belly might better be dilated when the stomacke is well stuffed or the wombe impregnated. The eleuenth sometimes, sometime also the twelfth are fastned to the Midriffe. Againe, the twelfth is the least of them all (and according to some mens estimation doth not deserue the name of a rib) that there might be roome left for the bowels in the lower belly, and because it was so little *Galen* calleth the eleuenth Rib the last. Sometime this twelfth Rib groweth to the oblique muscle of the *Abdomen*, sometime againe it is seen to haue a circumscription of a proper muscle whereby it is drawne downward.

All these ribs are not onely of a bony yet fungous substance, [table 18, figure 11, R] but also

also euery one hath his owne Gristles, both behind where they are articulated vnto the Rack-bones, and before where they are committed to the brest-bone, [ta. 18, fi. 9, AB shew the con-
iunction of the ribs with the gristles, C D. the coniunction of the Gristles with the brest-bone] But
the fore-gristles are greater and thicker, because the fore-part of the chest is distended and
contracted: so likewise the gristles of the bastard ribs are longer then those of the true ribs,
but the gristles of the true ribs are harder then those of the bastard ribs, because they were to
be ioyned with the brest-bone which is a harder substance, whereas the gristles of the bastard
ribs are thinne and narrow, because they are ioyned with other Gristles: and hence it is that
some Anatomists haue called them *χυδρος*, that is Gristles. Notwithstanding the Gristles of the
first and last ribs are very short, but that of the last is narrow and sharpe, that of the first broad
and large. The lower ribs in men remaine gristly euen to extreame old age; the vpper some-
what before that time do begin to grow bony, and haue, as we may say safely by *Galens* war-
rant, bony gristles. In Virgins after their paps begin to swell the gristles also grow somewhat
bony, the better to sustaine the waight of the paps that lye vpon them, whereby if the ribs
should be depressed, the motions of the Chest would be interrupted.

The figure of the ribs is semicircular like a Bow when it is drawne, to make the figure of the chest circular and round, whereby it becommeth stronger and more capacious. The length
of the ribs is not the same in them all, for the vpper & the lower are the shortest, the middle-
most are the longest and the broadest, excepting the first which is the broadest and shortest of
all the rest. Againe, the vpper ribs are more crooked and rounder bent, the lower are not so
embowed. All of them in their originall are narrow and somewhat round, and by how much
they come neerer to the brest by so much do they grow the broader, which broader part is
called *πλάτη*, or the Palme, the narrow part which is towards the spine *σπονδυλ*, the Rower.

They are also thicker aboue then below. On the outside especially where they are tyed to
the racke-bones they are rough [ta. 11, fig. 11 P] and vnequall, that from thence the Liga-
ments might proccede by which they are fastned to the Racks; in that place also they haue
two protuberations, one whereby [ta. 18, fi. 11, L] they are articulated to the sinus or bosome
of the Rack-bone, another where they are ioyned to the transuerse processe. [ta. 18, fi. 11, M]
They are also exasperated [ta. 11, fi. 11 Q] to receiue that Muscle of the Chest which is called
Sacrolumbus, accounted by *Vesalius* and *Falopius* for the fourth, by *Columbus* the fift Muscle
of the chest, as also for the originalls and insertions of the intercostall muscles. On the insides
they are smoothe, that they might not hurt the *Pleura*, and in the lower part of euery rib, [tab.
18, fig. 11 K] there runneth a sinus like a canale throughout their length to receiue three Ves-
sels, a Veine, an Artery and a Nerue, but the Nerue lyeth next vnto the ribbe: and these
sinus are most conspicuous in the middle of the Ribs, and in that part that is next to the Racke-
bones.

The vse of the ribs is to be a defence vnto the brest, that is, to defend the bowels therein
contained. Moreouer, to yeeld a fit place for the implantation and supportation of the Muscles
which serue for Respiration, that they should not fall downe and interrupt the functions of
the Heart and the Lungs. Wherefore, that when we breath in and breath out (though we be
faste asleepe) the chest might more easily follow his necessary constriction and dilatation, a
part of them was made gristly, which gristles likewise defend the bowels seated vnder them,
and sustaine some Muscles of the *Abdomen* which otherwise would fall inward and impeach
the offices of the bowels of the lower belly. And thus much of the Ribs.

CHAP. XXVII.

Of the Shoulder-blades.

TH E backpart of the chest is called the Shoulder-blade, in Latine *Os Scapula*, in His names
Greeke *ωμοπλάτη*. [tab. 19, fig. 7, 8, 9] There are two of them, one on each side,
which behinde fitteth vpon the top of the Ribs like a shield for their defence, and
is articulated with the clauicle and with the arme; for whose sake it was especially
created, as well to hold it to the body, as to affoord an originall to many Muscles by which
it is moued. It is fastned also to the ribs, to the nowle and to the bone *Hyois* by the interposi-
tion or mediation of Muscles.

The figure of it is after a sort triangular; on the inside [tab. 9, fig. 7, M] concanous: on the
outside

outside: [ta. 19. fig. 8, V, F] it is prominent, which place is called the Basis, and this basis hath an angle [ta. 19. fi. 7, 8, 9] *shew the upper Angle* and a rib both above and below; from which is produced a spine that looketh upward. [ta. 19. fig. 8. and 9, GH]

Table 19. Is the same with Table 16. a little before in folio 979.

The extremity of this Spine is commonly called *ἀκρόμιον*, albeit according to Hippocrates *Acromion* be the articulation of the clauicle with the vpper part of the blade or a gristly bone, which like a Ligament tyeth those Bones together.

Processes
three.

It hath three processes: the first is the shortest, and hath a short necke which is called *Scapula cervix*, [ta. 19. fi. 7, 8, CD] which Necke endeth into a sinuated or hollow *Cup* or head, [ta. 19. fig. 7 and 8 AB] which *Cup* receiveth the head of the arme, and it is compassed with a thicke gristle [ta. 19. fig. 8, K] whereby the *cup* is enlarged, that the head of the arme should not so easily fall out of ioynt. The second processe is the end of the spine, of which wee spake euen now, which hangeth ouer the ioynt of the arme, called therefore *Acromion*, [ta. 19. fig. 7, 8, 9 K] the point of the shoulder and the top of the shoulder, and by this processe the shoulder-blade is ioynd with the clauicle. The third processe is the least, and on the inside [ta. 19. fig. 7, and 8, E] which is called *σπυραιδης*, and from the likenesse it hath with an Anchor *ἀγκυραειδης*, Some call it *Coracoides*, because it is like the Beake of a Crow, and this processe holdeth the bone of the arme in his seat.

Appendices
five.

It hath five Appendices, three are at the inside and at the basis, and affoode an originall to some Muscles: [ta. 19. fi. 7, 8, 9 X] the other two do breed Ligaments which ioyne the arme to the head of the blade, and the clauicle to his second processe which we called *Acromion*.

Cavities
two.

It hath also two cavities, one above the Spine, and another below it, called *Interseapilum*. Finally, there is an inequality in this Bone, for in the middest it is very thin, in the processees thicke, medullous and fungous. It hath also perforations which admit Veines and Arteries for his nourishment. And thus much of the shoulder-blades.

CHAP. XXVIII.

Of the Hip, Hanch and Share-bones.



The third part of the Trunke was said to be the Bone without a name, so called first by *Oribasius*, some from the greater part called it the Hanch-bone: *Rufus*, *ἰσχυρὸς* *Coxa*. [ta. 20. fi. 12, 13, and 14] It appeareth to be one on each side, because the gristles are dried vp, but in children till the seventh yeare of their age it is found to be made of three Bones diuided by gristles, and therefore they are said commonly to be on each side three bones.

The Hanch
bones.

The vpper and broader parts which are ioynd with the Holy bone [ta. 20. fig. 13, ABCC DD] are called *ὀστέον ἰλίου*, in Latine *Ilium*, in English the Hanch-bone [ta. 16. fi. 1 mm, ta. 20. fi. 13, above T to f] Their semicircular circumference is called the Spine of the hanch-bone, [ta. 16. fig. 1 and 2, ii, ta. 20. fi. 13 HLMN] which is vnequall, that some muscles might take their originall therefrom, to wit, the oblique ascendent of the *Abdomen*, the fist of the chest, the first bender of the Leg, and the first extender called *Membranosus*. The inner part of the circumference is called *Costa* or the rib; the vtter part of the whole bone [ta. 20. fi. 14 at X] is called *Dorsum Ilii* the backe of the Hanch-bone, wherein there are vnequall inscriptions or lines for the three muscles of the Thigh which make the Buttocks.

The interior part is hollow and broad to affoord a fit and conuenient position to the internal Iliacke Muscles: [ta. 20. fig. 13 KK] above also it extuberateth for the Square muscle of the backe that is the first, and below for the tenth of the thigh.

The lower and vtter parts of this bone are called *ὀστέον κοξυδαις*, [ta. 16. fig. 1, nn. ta. 20. fi. 13, below T and f as far as to RP] in which there is a great sinus which they call *Acetabulum* and *Pixidem* [ta. 20. fi. 12 and 14 abc] the *Cup*, and properly in our English Tongue the Hip, to which the head of the thigh is articulated exceeding strongly. This *cup* or Hip hath a gristly processe, [ta. 20. fig. 12 and 14 e] called *Superoilium* or the brow, in whose circumference there are obserued three bosses, two protuberations. [ta. 20. fig. 12 and 13, T, V] an acute processe, [ta. 20. fig. 13 and 14 g] and finally an Appendix [ta. 20. fig. 13 and 14 i] that is very thicke; all these were ordained for the production partly of Ligaments, partly of muscles.

The Share-
bones.

Finally, the fore parts of this vnnamed Bone are called *ὀστέον ἰσχυρὸς*, *Pubis*, in English the Share-bones. [table 16, figure 1. and 2, pp, table 20, figure 13 and 14, that which is below R and e] because

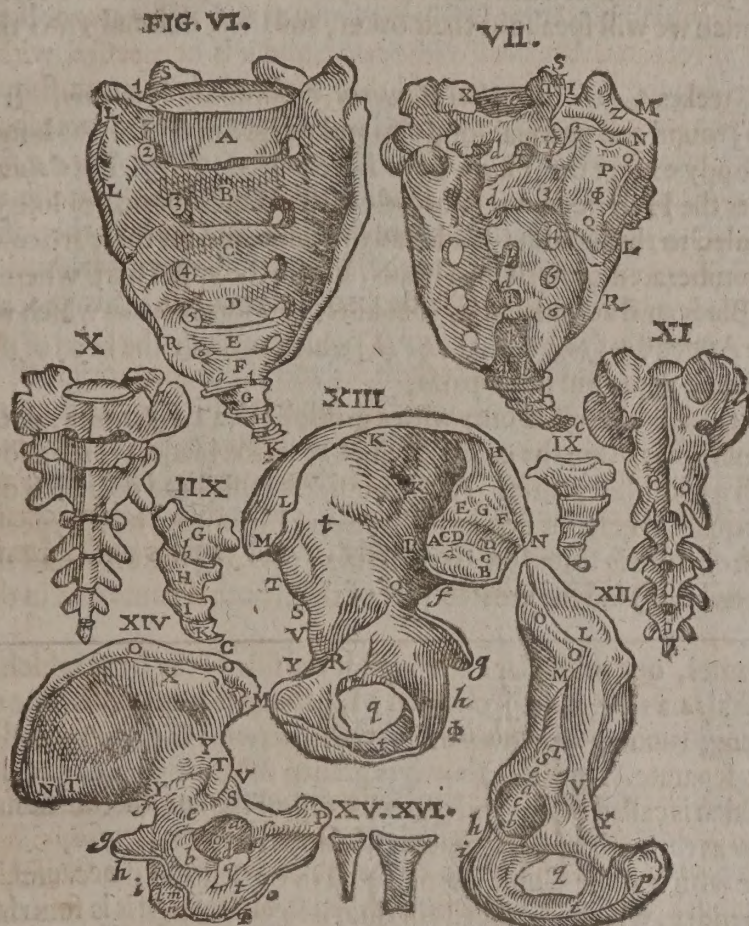
Figure 12. sheweth the forepart of the Coxendix which is ioyned to the right side of the Holy-bone.

Fig. 13, the inside of the Coxendix. Fig. 14, his outside.

Fig. 15. the gristle that goeth betwixt the Share-bone in a man.

Fig. 16. the gristle that goeth betwixt them in a woman.

TABVLA XX.



From T to f in Fig. 13, and 14, A part of the Coxendix called *Osiolum* the hanch bone, that which is below as far as to R and ϕ is called by the name of Coxendix the Hip, the remainder is the Sharebone.

ABCCDD 13, the foreside of the hanch bone where it is ioyned to the Holy-bone distinguished by a protuberation CC into two *sinus* ABDD.

EFG 13, the backside of the hanch bone which gapeth fro the Holy bone, & is filled vp by a gristle.

H 13, 14, a part of the backside reaching out beyond the proccesse of the Holy bone.

K 13, An impression in the inside of the hanch-bone made for the originall of the fift muscle of the backe.

L 12, 13, the inside of the appendix of the hanchbone.

M 12, the anterior end of the appendix.

N 13, 14, his posterior end,

O 12, 14, the outside of this appendix.

PQRI 13, A swelling from whence the tenth muscle of the thigh issues.

x 13, this place affoordeth an originall to the 7. muscle of the thigh.

S 12, 13, 14, the vpper *sinus* of the Coxendix, above which do run the sixt muscle of the thigh, and the 7. with a Nerue.

T 12, 13, 14, A higher protuberation above this *sinus* or cauity V. 12, 13, 14, another lower protuberation. XYY 14, a darke line in the backe of the hanch bone X, another in the same place YY. Y 12, 13, the vpper *sinus* of the Sharebone a b 12, 13, The Cup of the Coxendix which admitteth the head of the Thigh, the deepe hollownesse of it is marked with c. d 14, the *sinus* or bosome wherein the Cup is grauen. e 12, 14, the brow of the Cup. f 13, 14, a cauity of the Coxendix made for transmission of the fourth nerue of the Leg. g 13, 14, the acute proccesse of the Coxendix. h 12, 13, 14, a *sinus* to which the tenth muscle of the thigh is reflected. i 12, 14, the Appendix of the Coxendix. k l m n 14, diuers impressions in this appendix. o 14, the posterior end of this Appendix. p 12, P 14, the roughnesse of the Share-bone to which the gristle groweth. q 12, 13, 14, the hole of the Share-bone. s 12, 13, 14, a bosome about the hole of the Share-bone. t 12, 13, 14, the lower proccesse of the Share-bone.

because in the middle of the share they are ioyned together by a gristle. [ta. 20. fig. 15, at 6] Before and above they have a *sinus* or bosome, [tab. 20, fig. 12, r] made for the descent of the crurall vessell: they are also rough for the originall of the right and pyramidall muscles of the Abdomen, and of the second bender of the Leg. But otherwise they are but thin bones and perforated with the greatest hole that is in the whole body [tab. 16, fig. 1, and 2, qq. tab. 20, fig. 12, 13, and 14, q] This hole was made for lightnesse, and the empty place is stopped vp on the outside with the externall *obturador* or compassing muscle of the thigh, and on the inside with the internall, vnder the hole it hath a proccesse [ta. 20, fig. 13, 14, t] from whence the bodies of the yard and some muscles take their originall.

These Bones ioyned with the Holy-bone doe make that cauity which they call the *Bason* Their vses. [tab. 16, fig. 1, sheweth it] which containeth a part of the Guts, the Bladder and the Wombe; and to conclude, these three bones put together make the *basis* or foundation of the body, which it selfe is immoueable whilst all the body moueth vpon it. And thus much of the Trunke.

CHAP. XXIX.

Of the Bones of the Arme and the Cubit.

WE haue gone through the two first parts of the *Skeleton*, that is, the Head and the Trunke; the third remaineth which comprehendeth the Ioynts. These Ioynts are two, the Hands and the Feete. The Hand we call all that which is betwixt the shoulder-blade and the Fingers; and is deuided into three parts, the Arme, the Cubit and the Hand properly so called, of which we will speake in their order, and then descend vnto the Foote.

The names of
the arme.

The Arme is called by the Greekes *βραχιον*, by *Celsus* *Humerus*, commonly *brachium*. It is but one bone [ta. 21, fi. 1 and 2] round and vnequal, long also and the greatest of all the bones of the hand, yea of the whole body except the Thigh-bone if we beleue *Galen*. But *Columbus* saith that it is not so bigge as the Holybone, nor so broad as the Hanch-bone, nor longer then the Leg-bone. It is articulated to the shoulder-blade and the cubit, and for these articulations both the ends of it are protuberated or swell into heads. For in the vpper part where it is inserted into the *Cup* of the Blade, and articulated by that kinde of *dearticulation* which we called *inarticulation*, it hath an Appendix [ta. 21, fi. 1, AEFH] which maketh the head of the Arme or the *Acromion* seated in the vpper but inner parts.

One bone.

The head is large and orbicular, and crufted ouer with a gristle [tab. 21, fi. 1, and 2, ABC] that it might be turned in all motions within the cauity of the *Cup* of the blade, which also is enlarged for that purpose with a plentiful gristle. At the outside of this head do bunch out two processes rough and vnequall, whereout doe arise the strong Ligaments which tye the Arme to the blade. The first of these is seated on the fore side [fig. 1, D] the other and the greater on the backside [fi. 1, and 2, E] and the greatest part of them both is contained in the Appendix.

Two sinus.

It hath two *Sinus* or bosomes, one orbicular and rough at the side of the head which it distinguisheth from the processes [ta. 21, fig. 1, FG] to which a Ligament is implanted. The other is on the outside and long, running downward [fi. 1, HI] betwixt the two processes which it doth distinguish or separate. And this *sinus* was grauen for the beginning of the bending muscle of the cubit which is called *Biceps*, and groweth out of the *cup* of the shoulder-blade, for through this *sinus* as through a pulley that muscle doth run.

The lower part of the Arme which at the Cubit is articulated to the Ell and the Wand, is in Infants increased by an Appendix, which in proceffe of time is so vnited to the bones that there remaineth no footstep, no remembrance of the appendix. This lower part is broad and the figure of it diuers, for it is partly protuberated and partly excauated or hollowed.

The processes.

The protuberations or processes are two very notable on each hand, and one at the sides of the orbe, because it was to be articulated to two bones. The exterior of these [tab. 21, fig. 1, P] is the thicker, and endeth into a head crufted ouer with a gristle which entereth into the vpper *sinus* or cauity of the Wand. It is situate before, and is made round to turne the Wand vpward and downward. This processe at the outside buncheth out very farre, that from hence some muscles might take their originall [fig. 1. vnder Q] and endeth into an vnequall Line. Betwixt the head and the protuberation there is a *sinus* on the backside [fig. 2, R] grauen, to conuay the fourth nerue that passeth vnto the hand.

The inner processe [S] which may easily be felt euen in liuing bodies, and swelleth much inward to yeild a place for the originall of some muscles, is likewise crufted ouer with a gristle. Neare the side of the orbe it hath two *sinus* or cauities, one shallow in the fore side [fig. 1, T] to leade along the third nerue that passeth vnto the Hand; the other in the backside [fig. 2, V] through which the fift nerue is conuayed. Betwixt these two *sinus* we meete with an orbe, which saith *Falopius* may by a curious Anatomist be called a third appendix. *Archangelus* calleth it a third and middle processe.

It is also called *trochlea* or the pulley whereto the Ell is articulated by *Gynghimos*, and it is mooued onely with a right motion: this orbe because it hath a cauity in the middest [K] and buncheth out on either side [LM] seemeth to be like the gutture of a pulley wherein the cord doth slip, and therefore it is commonly called *Humeri rotula* the gutture of the Arme. [KLM] That part of this cauity which is like a pulley was at the first an Appendix; yea betwixt the two processes there went a gristle which after the senenth yeare groweth bony, and maketh a part of the cauity and the outward browe thereof. In the vpper part

of

Table 21. sheweth the Bones of the arme and the Cubit.

Fig. 1. sheweth the fore side of the right arme.

Fig. 2. The backside.

Fig. 3. & 4. Shew the inner and outward parts of the left cubit

Fig. 5 and 6. Shew the inner and outer parts of the left Ell.

Fig. 7 and 8. The inner and vtter scate of the left wand.

Fig. 9. The lower part of the left wand.

Fig. 10 and 11. The lower and vpper part of the right wand.

Fig. 12 & 13. The vpper & lower extremity of the right Ell.

TABVLA XXI.



A, B, C, 1, 2. The head of the arme which entreteth into the cavity of the shouderblade,

D 1, His anterior proceffe.

E 1, 2. the other posterior proceffe.

F G, 1, 2. the orbicular cavity of the head thereof.

H, I, 1, a right sinus leading directly downward.

K 1, 2. the sinus of the gutture of the arme which receieth the cubit.

L, M, 1, 2. the two lips of the gutture, the inner and the vtter.

N, I, 1, 2. the anterior sinus in the vpper part of the gutture.

O, 2, another posterior sinus.

P, I, 2. the head of the arme to which the wand is articulated.

Q 1, 2. a line swelling out in the vtter side of the arme.

R. 2. a bosome of the vtter proceffes of the arme.

S, 1, 2. the inner protuberation of the arme.

T 1, the anterior sinus of the inner protuberation.

V, 6, the posterior sinus of the same.

X, Z 2 the length of the arme betwixt his thicke ends.

Y 1, the middle part, where the bone of the arme is as it were written.

a 1, a bunching line in the fore-side, which runneth along as farre as to f.

b, c, 1. Impression on both sides the line.

d 1, the vpper gibbous part of the Arme.

e, 1, 2 a roughnesse in the outside of the middle of the arme.

f 1. another some what higher, but more inward.

Fig. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13.

A 3, 4. the vpper part of the cubit, wheerby it is ioyned to the arme.

B, 3, 4. the lower part of the cubit reaching to the wrest.

C 3, 5. 13. the anterior and vpper proceffe of the Ell.

D, 3, 4, 5, 13. the posterior and vpper proceffe of the Ell.

E, 3, 4, 5, a sinus of the Ell, receiuing the pully of the arme.

F, 13, a protuberation in the foresaid sinus.

G, H, I, 13. the internall side depressed nere vnto the protuberation at G. the externall side at H.

I, 13, a sharpe small cauity in the left hand, to which the right answers on the other side.

L, 3, 5. 13. an asperity in the roote of the proceffe of the Ell.

M, 3, 4, 7, 8. 11. the Necke of the Wand.

O 11. a sinus of the Wand whereinto the head of the arme doth enter.

P 3, 4, 5, 6, 12. the necke of the Ell.

Q, 3, 4, 5, 6, 12. the appendix of the Ell.

R, 3, 4, 5, 6, 12 the proceffe of the Ell called *Styloides*. S 12, a sinus or cauity in the basis of the appendix of the Ell. T 3, 4, 7, 8, 9, 10, a Gristle growing to this sinus. V 4, 6, a sinus in the side of the appendix of the Ell. X, Y, Z, 4, 6 three corners of the latter proceffe of the Ell. aa 3, 4, a line or the first bunching part of the Ell. bb 3, 5, the second line of the Ell. * an oblique inferior line of the Ell. cc, 3, 4, 5. the sharpenesse of the Ell touching the wand. dd 3, 6 the first vtter side of the Ell. e 4, 6. the 2 vtter side. f 3, 5. the lower rough side. gg 4, 6, a line drawne in the vtter side. h, i, 1, 3, the commissure of the wand with the ell about h and below i. i, k, 3 A distance where these bones doe part asunder. l, 13, a sinus of the Ell wherein the head of the Wand is turned. m, 7, 8. 11 the head of the wand, resting vpon the sinus of the Ell. n, 3, 7, the lower appendix of the wand. o 9, a Sinus of the Radius receiuing the head of the Ell. p, 5, 12, the head of the Ell entering into the Sinus of the wand. q, 3, 4, 7, 8. 11. a roughnesse swelling vnder the necke of the wand. rr, 3, 4, 7, 8. an acute line respecting the Ell and the wand. s, 3, 7, the rough internall side of the Wand. tt, 4, 8 the smooth externall side of the wand. u, 4, 7, 8. a roughnesse in the midst of the length of the wand. x y 3, 10. a Sinus of the wand wherevnto the wrest is ioyned. z 3, 10, a protuberation in the midst of the Sinus. a 3, 7, 8, 9, 10, the proceffe of the Sinus. b, 4, 8, the inner Sinus of the wand double which carieth the tendons. c 4, 8, the externall double Sinus of the Wand. d 4, 8, the fourth Sinus producing a Ligament. e 4, a Sinus of the wand common with the Ell.

of the Orbe there are grauen two cauities or bosomes, which *Hippocrates* called *βαβυιδες*, distinguished onely by a scale: one of these is in the forepart, [figure 1, N] the other which is the larger and the deeper [figure 2, O] is in the backpart, and these two are the limites of the motion of the Ell. Moreover this bone throughout his length is round in the midst, [figure 1, b] in the sides a little compressed, [figure 2, a c] behind yet more depressed, wherein there is a shallow gutture [fig. 2 R] whereunto the fourth Nerue of the arme creepeth; before, there is a double asperity or roughnesse, one [figure 12, c] made for the stronger implantation of the muscles that moue the arme, and for the originall of the muscle which is called *Brachieus*. In old men the roughnesse is so great that from thence there seemeth a proceffe to grow, whereunto the muscle called *Deltoides* is inserted. The other *Asperitie*, [figure 1, f] is that whereto the fleshy part of the Double-headed Muscle doth grow.

Perforations. It hath also small perforations nere the browes of the head and the bosomes, through which some Ligaments are produced or implanted; and moreover some other perforations it hath on the inside of the length of the bones which admit certaine veines. Finally, the bone of the arme is on the inside hollowed with a deepe bosome or cauity, as well to containe the Marrow which is his Nourishment, as also to make the Bone the lighter.

The Cubite. The second part of the hand in the large acceptation is called the Cubit, and is seated betwixt the Arme and the wrest, with both which it is articulated. It consisteth of two bones lying one vpon another, and fastened together with a Membranous Ligament. These bones are long, but yet shorter then the bone of the arme, and they haue appendices at either ends.

The Ell. The lower of these [fig. 3, 4 AB 5 6] which is also the greater, hath for the most part the name of the whole and is called *Cubitus*, yet to put a difference it is also called *Vlna* the Ell, and sometime *foeile manus*, and is articulated to the sinus [figure 2, KLM] which is in the gutture of the arme by *Ginglymos*, and by this articulation both flexion and extention is made.

His processes. It hath in the vpper part two notable processes, long and as it were triangular, but the angles are obtuse or dull, and these processes together with the cauity in the midst, which is called *Sigmoides*, are in yong infants gristly, yet the anterior processe together with the cauity do quickly become bones, and the marke of the appendix is obliterated. The Posterior processe beginneth not to harden till after the seventh yeare, and then it is agglutinated or fastened to the rest of the bone.

The Elbow. The Anterior and vpper of these [figure 3, 5, 13, C] entreth into the Sinus or cauity of the Arme, [Figure 1, N] and is crufted ouer with a gristle on the inside; the posterior [D] is the thicker and the larger, which *Hippocrates* calleth *ἀγλῶνα*, *Galen* *ἀνέχρανον*, the Latines call it *Gibberum*, and we the *Elbow*; it entreth into the posterior cauity of the arme. [figure 2 O] The places of both these processes are rough, [Figure 13, CD] partly that the Ligaments might more strongly encompassse the ioynt, partly for the insertion of some muscles of the cubit, partly also to giue originall vnto the muscles that bend the Fingers; for which cause also the bone is rough at the roote of the processe: [Figure 5 and 13 L] the circumference also of the Sinus or cauity is rough [figure 13, IK] that from thence Ligaments might yssue, for in the middle of these processes there is a great Sinus [figure 3, 5 E betwixt CD] which receiue the gutture of the arme. This sinus is hollowed like a semi-circle, and being concluded or closed vp by these swelling processes, representeth the forme of the Greeke *Sigma*, and therefore by *Galen* is called *σγμοειδής*, and is crufted also ouer with a Gristle. But because it might be fitted exactly to the gutture of the arme, it hath in the midst an obrose protuberation, [figure 13 between FF] and at the sides on either hand is compressed, [figure 13, GG, HH] so that it may be compared to a cord compassing the gutter or rim of a wheele, that in it the cubit may be bent and extended: and from it is separated by a swelling line, least the Ell should slippe this way or that way: hence comes the mutuall ingresse of the bones one into another, which kinde of articulation is called *Ginglymos*, which we know not how better to expresse, then as the crookes of a paire of Hinges doe receiue and are receiued one of another. There is yet another Sinus at his outside smooth and crufted ouer with a gristle, [Figure 5. and 13, I] which receiue the head of the *Radius* or Wand. [Figure 7, II m]

From hence the Ell descending growes slenderer by degrees, [Figure 3, from A to B] and at the

the wrest is encreased with a small necke, [fig. 3, 4, 5, 6, 12 P] It hath also a round Appendix or an obtuse head inclining inward, [fig. 3, 4, 5, 6, 12 Q] about which the Wand is led vpward and downward. Finally it determineth into an acute proceffe, [R is the same figures] which is called *Styloides*, because it is like a probe or writing pen which the Ancients were wont to vse, not much vnlike a long Bodkin; and from this Bodkin there groweth a Ligament which firmeth or fasteneth the ioynt of the wrest with the Ell. At the basis also of this appendix there is grauen another vnequall sinus [f. 12 S] which distinguisheth the Appendix of the Ell from the wrest, and to it there is adioyned a gristle which is placed betwixt this articulation; [fig. 3, 4, 7, 8, 9, 10 T] another sinus somewhat long is grauen on the outside betwixt the two protuberations, [fig. 4, 6, 12 V] to guide and direct the tendon of the first muscle that extendeth the wrest. [T]

Furthermore, the Ell on the lower side vpon which it resteth when we leane, is gibbous a good way, [fig. 6, XYZ] and beside there are foure swelling lines which run throughout his length made for the vse of the muscles of the wrest. The first [f. 4 and 6] from z by a. [and f. 1, aa] The second ariseth or swelleth more toward the wrest [fig. 3, 5, 6*] for the originall of the Square muscle. The third is the sharpest and the roughest [fig. 3, 4, 5, cc] that from thence might arise a Ligament which like a membrane fasteneth together the Ell and the Wand. The fourth is prominent indeed but obtuse or blunt [f. 4, and 6, gg] from which three muscles haue their originall.

The forme of the Bone.

The vse of the Ell is, that the Hand without danger might be moued outward, and againe with facility returne inward.

His vse.

The other bone of the Cubit which is the vpper and the shorter, and occupieth almost the whole exterior part of the cubit [f. 7, and 8] is called *radius*, by some *Focile minus*, in Latine *Radius*, in English the Wand. This bone in respect of the Ell is oblique and is committed or ioyned thereto aboue and below, [f. 3, bi] so that aboue, the Ell receiueth the wand, below the wand receiueth the Ell; but in the midst they stand off one from another a good distance, [Figure 3, kk] partly that the Wand might more readily be moued vpward and downward, partly that a place might be made for the muscles which extend the Cubit.

The Radius or Wand.

This wand is articulated to the arme *per Diarthrosin*, by *Dearticulation*, hauing an oblique and slender necke; [f. 7, 8, 11, M] a round and depressed head, [f. 7, 8, 11, N] crufted ouer with a gristle for more agility of motion, but where it regardeth the arme it hath a round or superfiary bosome [f. 11 O] into which the head of the arme entreth, [fig. 1, P] and at this head the Wand when the Ell is at rest is turned downward and vpward. A little aboue the necke it hath a rugged and abrupt proceffe or protuberation [f. 4, 5, 7, 8, 11 q] into which is inserted the tendon of the anterior muscle that bendeth the Cubit; so also through his length there runneth an acute and bunching line [fig. 3, 4, 7, 8, rr] vnto which is fastned a Ligament that ioyneth the Ell and the wand together on either side, with which line the bone is compressed [fig. 3, 7, f. and fig. 4, 8, st] to giue way to the Muscles. The bone also it selfe throughout the midst of his length is rough, [Figure 4, 7, 8, u] so made for the insertion of two muscles of the wand. This wand below at the wrest is dilated, and groweth thicker, because of a bosome therein to be made for the articulation of the wrest with the cubit.

It also hath an appendix [f. 3, 7, n] with a double bosome crufted ouer with a gristle, [f. 5, 12, o] that therein the head [f. 4, 12 p] of the appendix of the Ell which is also couered with a Gristle might be moued. This bosome or cavity was made double [fig. 3, 10, xy] because there are two bones of the wrest articulated therewith, to wit, the first and the second: [14. 22 f. 1, 2, 4, 5, char. 1, 2] also where these two are ioyned together, the sinus protuberateth moderately in the midst, [f. 3, 10, z] yet beside that protuberation it hath also a proceffe. [f. 3, 7, 9, 10, a]

His Appendix dancet.

The outside of the Appendix of the wand, as also of the wrest is gibbous, and therein hath foure sinus insculped or grauen, [fig. 4, 7, d, e, z, n] thorough which the tendons of the muscles might be more certainly conducted through the annular Ligament. The fourth of these [n] is very shallow but rough, for it bringeth forth a transuerse Ligament and beside swelleth vpward, for into that swelling the tendon of the Long muscle which turneth the wand vpward is infixed.

The Sinus

There is also in the same place another sinus common to the Ell and the wand [fig. 4, o] made for the Tendon of the muscle that extendeth the little Finger.

Both

The confi-
stence of the
Bones of the
Cubit.

Both these bones of the Cubit are of a solid and hard substance excepting their Appendances, and full of final holes bored also to containe marrow, but if you consider them apart they are one contrary to another in respect of their parts, for the vpper part of the Ell is the thicker the lower is the thinner, contrariwise the vpper part of the Wand is the thinner and the lower is the thicker. Finally, the vse of the wand is to moue the Hand downward and vpperward, as also in compasse, although the Ell, saith *Archangelus*, be not moued.

CHAP. XXX

Of the Bones of the Hand properly so called, that is, of the Wrest and After-wrest.



THE Bones of the Hand doe follow in the next place which are of foure sorts: first those of the wrest; secondly those of the afterwrest; thirdly the bones of the Fingers; fourthly the Seede-bones called *Sesamina*.

The wrest.

The Wrest is called in Greeke *καρπός*, in Latine properly by *Celsus brachiale*, but the Greeke word is also among the Latines grown into vse, which is *carpus*: we call it the Wrest, which is that patt of the Hand which is articulated to the Cubit and to the After-wrest, and is construed or made of eight bones; most Anatomistes say of seuen, but because the first is thought to be double, therefore saith *Archangelus* we account eight.

Eight bones.

These bones are distinguished in a double order, the reason was that the Hand might be moued with more agility. [ta. 22, fig. 3, char. 5, 6] These eight bones do differ in their magnitude, forme, situation and consistence, and in the first generation are all gristles and not bones but in proceffe of time they become hard and grow bony. Their substance is spongy as are all the rest of the bones which of gristles become bony, of which kinde are all *Appendices*, the bones of the wrest and such like. These bones are not without marrow, and beside are couered ouer with gristly and strong Ligaments, whereby they are so compacted together (but the vpper more then the lower) that if you doe not deuide the Ligaments and the Membranes also, you will thinke that they are but one bone, which hath deceived some Anatomists.

Their surface.

They haue a double *superficies*, the one *exterior* and gibbous [Fi. 4] the other *interior* and sinuated or concaveous, [fi. 3] and above, where they are ioyned to the Cubit, as also below where they are articulated with the After-wrest they are all smooth and crufted ouer with a gristle: but beside that gristle where they touch one another they haue also *sinus* or cauities

Their articulation.

and heads crufted with a slippery gristle: and this articulation of these bones is to be referred to that third kinde which *Galen* calleth *Neutrall* and doubtfull; for in respect of their composition it may be called *Dearticulation*; and in respect of their pure motion it may be called *Coarticulation*. Foure of these are reposed in the vpper ranke of the wrest which is next vnto the Cubit, [ta. 22, Fi. 1, 2, 3, 4, ch. 1, 2, 3, 4] the other foure in the lower ranke. [cha. 5, 6, 7, 8] But because these bones want proper names, therefore they are distinguished onely by their order and number.

The first bone of the wrest.

We call that the first which maketh the inside of the vpper ranke. It is a long bone curved inward and articulated to the Wand together with the second bone of the later ranke, and his head entereth into a *sinus* of the second bone on the inside. Another head it hath also which is greater then the former and lower, and entreth before, into a *sinus* formed by the fift and sixt bones. It hath also a notable *sinus*, wherein together with the second bone it admitteth on the inside the head of the seuenth bone.

The second.

The second bone of the wrest leaneth vnto the former and is lesse then it: it is reposed behind in a *sinus* insculped in the appendix of the Wand, [ta. 21, fig. 3, 10. xy] and is ioyned on the fore side with the first bone, below with the seuenth, behind with the third hauing a plaine *superficies*.

The third.

The third is ioyned with a plaine *superficies* also to the Ell and his gristle: [ta. 21, fi. 3, 4, 7, 8 T] againe to the second and the fourth; and below it hath a large head, which entreth into a *sinus* of the eight bone.

The fourth.

The fourth bone is called *Os rectum* the Right-bone, and is the hardest and the least of all the rest, and almost round, for it is neither hollow nor protuberated as the rest are. It is ioyned with a depressed head to the externall side of the third bone, and seemeth also to be a little inserted into the proceffe of the eight bone; otherwise it toucheth no bone of that ranke, but in the vpper part thereof the Tendon of the muscle that bendeth the wrest is inserted; below, two muscles haue their originall which goe into the little Finger.

The

CHAP. 13.
Table 22, Fig. 3, of the Hand
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Table 22. Fig. 1 and 2. The first sheweth the inside of the bones of the Hand, the second the outside.

Figure 3. and 4. shew the inside and outside of the bones of the wrist.

Fig. 5. The posterior part of the bones of the wrist articulated to the Cubit.

Fig. 6. their anterior part ioyned to the Afterwrist.

Fig. 7. Two bones making the first Ioynt of the Fingers.

Fig. 8. The second Ioynt.

Fig. 9. The third Ioynt.

Fig. 10. A Naylor parted from the Finger and shewed on both sides.

Fig. 11. The Seede-bones in the Foote & the Hand.

TABVLA XXII.



B 7, The first bone of the Fore finger. **C 7**, the round head of the bone of the afterwrist. **D 7**, a Sinus of the Fore finger receiving the foresaid head. **E F 8**, the first bone of the Fore finger **E**, the second **F**. **G H 8**, two small heads of the first bone of the Fore finger. **I K 8**, two Sinus of the second bone of the Fore finger. **L 8**, a Sinus betwixt the two small heads of the first bone. **M 8**, a small head betwixt the two Sinus of the second bone. **N 9**, the second bone of the Fore finger and his two heads. **O 9**, the third bone of the Forefinger containing a Sinus. **Fig. 10.** **A 10**, The inside of the naylor hollow. **B 10**, his soft roote which the skin is wont to cover. **C 10**, the outside of the naylor gibbous. **Fig. 11.** **A 11**, the lower side of the Seede-bone that is placed before the first ioynt of the thumbe. **B 11**, the vpper part of the same which is next vnto the ioynt. **C 11**, the vpper of another Seede-bone. **D 11**, the lower part. **aa 11**, the Seede-bones at the ioynt of the thumbe. **bb 11**, the Seede-bones at the ioynt of the Forefinger. **cc 11**, Seede-bones placed at the little finger.

A 1, 2, The first bone of the Afterwrist supporting the thumbe.

I, II, III, IIII, The four other bones of the Afterwrist ioyned to the fingers.

B C 1, 2, the two bones of the thumbe.

DEF 1, 2, the three bones of the fore-finger, the same also in the rest of the Fingers.

G 3, 6, The gutter of the fist bone of the wrist whereto the first bone of the Afterwrist is articulated.

a b 6, the length of this gutter:

c d 6, The inside of the gutter **c**, the outside **d**.

e 3, 4, 6, A Sinus at the gutter **c**, which the second bone of the afterwrist doth touch.

H 3, 4, 6, The Sinus of the fist bone of the wrist whereto the second bone of the afterwrist is ioyned.

f 3, 4, 6, a part of this Sinus which the third bone of the afterwrist scarcetoucheth.

I 3, 4, 6, the Sinus of the seventh bone of the wrist, to which the third bone of the afterwrist is ioyned.

K 3, 4, 6, The place of the eight bone of the wrist which admitteth the fourth bone of the afterwrist.

L 3, 4, 6, a Sinus of the same bone receiuing the fist bone of the afterwrist.

M 1, 2, a small bone placed sometimes outwardly at the ioynt of the eight bone of the wrist.

N 1, 3, 6, a proceffe of the same eight bone swelling out into the ball of the hand.

O 1, 3, 6, the proceffe of the fist bone of the wrist from whence groweth a Ligament.

P 2, an appendix of the wrist whereby they are ioyned to the afterwrist.

Q 2, Another appendix which with the head entreteth into the Sinus of the fingers.

R 1, 2, the distance betwixt the bones of the afterwrist.

S 1, 2, two Seede-bones set at the inside and outside of the first ioynt.

T 1, 2, two Seede-bones in the first ioynts of the four fingers.

V V 1, one Seede-bone in the second and third ioynts of the fingers.

Char. 1, 2, 3, 4, 5, 6, 7, 8, these numbers in six fingers doe shew the eight bones of the wrist.

Fig 7, 8, 9.

A 7, the bone of the afterwrist which supporteth the fore fingers.

The fifth

The fifth bone of the wrist on the outside toward the thumbe, receiveth into the vpper sinus the posterior head of the first bone on the inside, it receiveth into another Sinus the head of the sixth Bone. It hath also a lower Sinus [tab. 22. fig. 3, 6 G] which is long [fig. 6 a b] grauen somewhat deepe in the inside and the outside, [fig. 6 c d] wherein it receiveth the head of the first bone of the thumbe, as also a part of the fifth bone of the After-wrest. [fig. 3, 4, 6 e] It produceth also on his inside a proceffe [fig. 1, 3, 6 O] to make way for the Tendons of the Muscles that bend the fingers, and so with the fourth bone maketh that passage hollow.

The sixth

The sixth Bone receiveth into his sinus on the backside the first bone, and his onward head entreteth into the sinus of the fifth, his inner head also is ioyned with a plaine superficies to the seauenth bone. This bone also receiveth the first bone of the After-wrest which supporteth the roote of the fore-finger, [fig. 3, 4, 6, H] but the second more obscurely, [fig. 3, 5, 6, f.]

The seauenth

The seauenth, which is the greatest of the second ranke (as the sixth is the least) is easily luxed because of his lax connexion. It hath a round head which entreteth into the sinus which is common to the first and second bone. It is also loosely articulated on the inside to the sixth bone, on the outside with a depressed head to the eighth bone, whereto it is likewise ioyned by interposition of a gristly Ligament. Finally, it is fastned to the second bone of the After-wrest.

The eighth.

The eighth bone which like a wedge is placed between the third and the seauenth bones is ioyned at the left side with a depressed head to the third bone. On the right side with a depressed Sinus to the seauenth: before, his superficies is broad, [fig. 3, 4, 6, K] whereby it is ioyned to the third bone of the After-wrest and receiveth in a certaine Sinus [Fig. 3, 4, 6 L] the Head of the fourth bone of the After-wrest. It also produceth in the inside of the wrest a proceffe which inclineth from the out side inward, exculped or grauen like the letter C. to make the hand hollow to containe the tendons of the muscles that bend the fingers. Out of the toppe of this proceffe groweth the transuerse Ligament of the wrest, and to it is fastned a seed-bone- [Fig. 1 and 2 M] And thus much of the wrest.

The after-wrest.

The next part of the Hand is called in Greeke *μετακαρπιον*, in Latine *Postbrachiale*, by some *Ima palma*, wee will call it the After-wrest. It is that part of the hand which is betwixt the wrest and the rootes of the Fingers, and consisteth of foure bones, of five say some Anatomists, who reckon the first bone of the thumb with the After-wrest, because we do not meete with it so bare as the bones of the rest of the Fingers are, but it lyes deeper as the other bones of the After-wrest. [tab. 21, fig. 1 and 2]

The bones of the after-wrest

These bones of the After-wrest being placed betwixt the wrest and the bones of the Fingers, [char. I. II. III. IV] are ioyned to the wrest by *Coarticulation*; or rather by *doubtfull articulation* as they are ioyned to the bones of the Fingers by *dearticulation*; for all the bones of the After-wrest where they regard the Fingers do end into a rounde head, that so they might enter into the shallow or superficiali cauities of the subsequent ioynts. Among themselues they are ioyned onely by contaction of their extremities towards the bones of the wrest, where they are fastned with gristly Ligaments. [fig. 2 P]

These bones of the After-wrest are longer then the bones of the fingers, and the first of them which standeth before the fore-finger is the longest and thickest of them; all the rest are by degrees shorter and thinner; beside they are all somewhat broader on the outside then they are on the inside.

Toward their extremities they grow thicke and haue *Appendices* growing to them aboue and below, [fig. 2 P Q] out of which *Appendices* yssue Ligaments whereby these bones are ioyned together though that coniunction be somewhat dissolute or loose: for the vpper are fastned to the bones of the wrest, but the *Appendices* themselues are tyed together by the interposition of a gristly Ligament. The lower *Appendices* which are the greater, are fastned to the bones by coalition, for their head is round and long, forward and backward, lengthned out somewhat to the sides, and crufted ouer with a gristle, and these heads do insinuate themselues into the Sinus of the first bones of the fingers.

These bones are after a sort round, yet haue they as it were three sides, two inward sides ending into a line the better to giue way to the muscles called *Interossei* or the *bone-bound* Muscles, [fig. 1] and one externall which maketh the hand plaine. [fig. 2]

The distance betwixt them

There is also betwixt these Bones an intermediate distance, [fig. 1, 2, R] in which distance the *bone-bound* muscles are placed; that is to say, two in euery distance. And because the

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the palme of the Hand should not swell too great by the bellies of these muscles and so bee made lesse fit for comprehension, as also that the place might be sufficient to containe them; these bones on the inside which is next vnto the palme are curued and their outside is gibbous: they are also cornered and haue swelling lines in them made for the insertion of the muscles in that place.

The first bone also where it is articulated with the wrest hath a processe [*tab. 22. fig. 1,* *aboue char. 6, and 7.*] whereinto the second muscle that bendeth the wrest is inserted. In like manner the fourth bone swelleth on the outside [*fig. 1, aboue M*] into which swelling the third muscle of the wrest is inserted. Note also that the palme of the hand is especially made hollow by the first bone of the thumb (which some make the first of the Afterwrest) and by the fourth of the Afterwrest, for the other three doe helpe that cauity but little.

Finally, the bones of the Afterwrest are fistulated or hollow to containe the marrow. Their vse is to establish and strengthen the Palme, that it might comprehend or containe whatsoeuer it is applyed vnto with more stedfastnes. And thus much of the Wrest and Afterwrest.

CHAP. XXXI.
Of the Bones of the Fingers.

THE Fingers which make the third part of the Hand are construed or compounded of fifteen bones: for we say (saith *Baughine*) that the thumbe also hath three bones. And because they stand as it were in rank, therefore the Grecians haue called their order *κατάγγρας*, as it were the Files of a battell disposed in order.

The particular bones doe want proper names, and therefore are expressed by the names of the fingers to which they appertaine, as the first bone of the thumbe or the forefinger; the second and the third and so in the rest. Their number was with wonderfull wisdome ordayned as was fittest for the facility and variety of motion, for if they had beene more they could not haue beene perfectly and strongly extended: againe, if they had beene fewer the fingers could not haue beene moued into so many formes. *Galen* in his first and second bookes *de usu partium*, hath so elegantly discoursed of the counsell and wisdome of Nature in this poynt that it will not onely delight any man that shall reade it, but also transport him (as himselfe seemeth to haue beene transported) into an admiration of the wonderfull wisdome of the Creator.

The forme of these bones on the outside (excepting the last) is gibbous and crooked, on the inside it is plaine and somewhat hollowed or sadled, partly because wee apprehend with the inside of the hand, partly because more tendons run into the inside then into the outside. Furthermore on their inside there are certaine lines running on both sides the bones throughout their length, from which lines certaine Ligaments are produced; which like rings doe encompassse the Tendons and hold them stedfastly in their places. These bones although they be hard and fast or dense that the hand might vse them in manifold employments without danger or annoyance, yet they haue a cauity or hollownesse within them which containeth marrow.

Their magnitude is diuers, for the first bone of each finger is larger in all the dimensions, that is, thicker, longer and broader then the second, [*tab. 22, fig. 1, and 2,*] in like manner the second is greater then the third, for Nature provided that the thicker finger should haue the thicker bones, and the longer finger the longer bones. Notwithstanding albeit their magnitude is not the same, yet they appeare all equall, & all the fingers are brought together into one right line when wee would comprehend any round body. Moreover they are in the beginning broader, and so grow narrower by degrees. At the ioynts all the bones are somewhat thicke, that the *basis* being the larger, the construction might bee more substantiall: in their length they are not all of a thicknesse least their quantity or waigh should haue beene offensive. The swelling protuberations of the bones are called *κόρυλοι* *Knots*, but in English Knuckles.

The bones of the first and second ioynt haue *Appendices* aboue and below made for the originall and insertion of muscles: the bones of the third ioynt haue *Appendices* onely aboue; for the very end or head of the fingers being not articulated againe but onely ioynted with flesh or a nayle, needed no Appendix at all: they are also cruisted ouer with gristles that the ioynt might be at all times glib and easie to moue.

The first bone
of the thumbe.

The first bone of the thumb [Tab. 22. fig. 1 & 2 A] aboue hath a long sinus, but before & behinde it buncheth out, that it might ioyne with the farrow or gutter of the fift bone of the wrest. It is manifestly mooued directly outward and inward toward the palme; side-ward toward the forefinger, from which also it is remoued by reason of the length of the guttur, and beside it is turned circularly. But if the head of the bone of the wrest bee produced more backward, then is the bone of the thumbe easily and directly bent backward, so haue I seene a man able to lay the Naile of his thumbe vpon his wrest. Some also will in like manner turne all their fingers vpon the backe of their hands. Aboue, this first bone of the thumbe hath a head but not perfectly round, which entreth into the sinus of the second bone.

The second

The second bone of the Thumbe where it regardeth the third is diuided by the Mediation of a long sinus [fig. 8. L] into two long heads; [fig. 8. G H] protuberating before on either side.

The third.

The third bone hath two Sinus [fig. 8. I K] distinguished by a long knot, [M] whereinto the heads of the second bone are receiued: againe the knub of the third bone entreth into the Sinus of the second; so the second is receiued of the third, and receyueth the third, making thereby a *Ginglymos*, wherein the two Bones are so straightned, that onely the third bone can be bended or extended.

The Bones of
the Fingers.

After the same manner are the articulations made of the rest of the fingers, for they haue two heads and two bosomes. But the first ioynts of the foure fingers haue but one head and one bosome, because the bones of the After-wrest haue each but one Head, which looketh especially into the inside of the Hand, and hath more a boundance of gristly substance about it. The Sinus in the first bone of the foure fingers is orbicular, and aboue that head the first bone is bent, extended and moued to the sides. The third bone also it selfe swelleth into a gristly top and rough head [fig. 9 O] whereinto is inserted the Tendon that benderh it. Moreouer, all the inside is rough and vnequall, and at the end it is not knotted as the first and second bones are, but lyeth plaine to giue way vnto the Nayles.

CHAP. XXXIII. Of the Seede-bones.

How to finde
the seed bones



THE last thing to bee considered in the Hande are the Seede-bones, called *moeddy* [tab. 22. fig. 9.] because they are like *Sesamum* seede. These Bones are placed in the ioyntes or knuckles of the fingers and of the toes: for the most part they grow vnto the Tendons and lurke vnder them; and therefore he that would make demonstration of them must seeke for them in the dissection of the Tendons of the Muscles which are seated about these bones. Moreouer, they are so entangled with ligaments, that if you desire to clense the bones, you shall take them away with the Ligaments vnlesse your care be the greater. They are crufted ouer with gristles and touch the slippery side of the other bone. Solid they are, round, a little depressed, sometimes gristly, sometimes bony, within fungous and full of pores, wherein they containe a iuyce which serueth them instead of marrow.

Their number

These Seede-bones are commonly in each hand twelue; one standeth before the middest of the third ioynt, two at the second ioynt of the thumbe, [fig. 1 and 2. S] two lesser which are gristly in the first knuckles of the foure fingers [fig. 1 T] which leane vpon the tendons, and are bent on either hand at the sides of the ioynt with the double tendon. In the rest of the ioynts of the foure fingers, that is, in the second and the third at each ioynt there is one bone, which is placed before the middest of one single tendon, and these are much lesser, [Fig. 1 V] and as it were gristly, but yet larger in the hands then in the feete: in old men they grow big and almost plaine, in children they are but gristly and scarce conspicuous in the Tendons. Their number is not certaine as is the number of other bones, partly because they are so small that they are lost in dissections, partly, saith *Archangelus*, because for want of seede Nature omitteth somethings which are lesse necessary in the frame of the body.

There is one little bone amongst these Seede-bones which may be numbred twice [fig. 12 M] because it is found in the hand neere the connection of the bone of the after-wrest which sustaineth the little Finger with the eight bone of the wrest, for it filleth vp a place there on each side.

The vse of these Seed-bones is foure-fold: the first, that in certaine motions by their hard-

hardnesse they might be better able to receiue and sustaine the violence of the bone mo-
ued; for the Tendon is defended with such a small seed-bone to keepe it from shouldring
vpon it selfe; for, in the extention of the fingers they insinuate themselues somewhat into
the space of the ioynt, and returne or holde the Tendon, least in the motion it should fall
from the ioynt as it swels.

The second vse is to hinder the bone, at which it is set, from luxing easily out of his ioynt,
and so they are a defence to the ioynts, like as in the great ioynt of the knee the whirlbone
is as it were a shield or muniment to keepe the bones from luxation.

Their third vse is to fill vp the distances which remained empty betwixt the bones of the
fingers, and so againe they adde strength vnto the ioynt.

Fourthly, to make the action of the hand which is apprehension more firme and con-
stant. And this shall bee sufficient to haue said concerning the bones of the whole hand.
Onely we will adde.

That on the outside of the fingers there are nayles set [Tab. 22, fig. 12] to make their
apprehensions more distinct and strong, and these nayles are neyther longer nor shorter
then the ends of the fingers are, and therefore when they grow longer wee pare them off,
otherwise they would hinder apprehension. And thus much of the bones of the hand.
Now wee proceed vnto the Foote.

CHAP. XXXIII.
Of the bones of the Thigh.



HE Ancients called all that the foot which is betwixt the top of the Thigh and
the top of the great toe. The bones of the Foote are 42, and belong some of
them to the Thigh, some of them to the Legge, and some to the Foote com-
monly so called.

The Thigh is called by the Grecians *μυῖς*, by the Latines *Femur a ferendo*, because the
creature is borne or sustained especially by these parts. It is also called *Femen* although
saith *Varro* in his fourth booke, *Femina* are properly the inner parts of the *Coxa*, and *Femo-
ra* the outward. The bone of the thigh is but one as is the bone of the arme. [Tab: 23, fig.
1, 2, 3.] In a man and an Ape it is the longest bone of the body, in other creatures where-
in a great part of it lyeth hid, it is shorter then the Legge as it is in Birdes. The position of
it is obliquely inward to the knee from the Hip-bone. The figure of it is long, round and
strait, but not exquisitely because it descendeth obliquely inward at the knee to make the
station or standing, the walking and running more firme and strong, which also *Galen* eu-
idently declareth in the 9 chap. of his booke *de vsu partium*; for those men whose Thighes
are more streight and direct then it behooued, are called *Vari* and become lame in their
knees. And it behooueth much that wee should marke this posture of the Thigh bone
(being thereto counselled also by *Hippocrates*) least if it be broken and be to be restored a-
gain, he that mends the breach should turne it the wrong way.

On the foreside it is gibbous, and that is profitable not onely for Session and sitting;
but for many other labours or operations which are performed when wee sit, as if a man
would write vpon his knee, hold a Viall or any other thing betwixt his legs, or lay one leg
ouer another. In the sides it is round and smooth on both hands, on the backside doked
or hollow: aboue it endeth into a head, a necke and two processe, below it determines
into a head which hath two productions and bosomes.

The vpper head [Tab. 23, fig. 1, 2, A fig. 3, XT the vpper] is wholly made of an orbicular
Appendix which it hath, and is thicke and the largest head in the whole body. In so much as
Hippocrates, in his booke *de fracturis*, calls it by an excellency *ἀρθρον*, *Articulū* the ioynt. This
head is round and long, the better to enter into the cup of the hip-bone which is not onely
deepe of it selfe but indeed deeper by a large gristle that compasseth the verges thereof.

And the reason why this cup was so deepe and the head so long, was that the articu-
lation should bee exceeding strong because of the enorme and huge waight which the
thigh was to sustaine. It is therefore articulated by *Inarticulation* which is a kinde of
Dearticulation, and beside to strengthen it the more, and to fasten the two bones together,
there ariseth out of the cup of the hip an exceeding strong and round ligament which is
implanted into his *Sinus*, [Tab. 23, fig. 2, B] seated vnder the top of the head which is nar-
row and deepe. The head also is smooth and crufted ouer with a gristle, that so the thigh

Femina;
Femora.

The figure of
it.

Head;
The vpper

might more easily and with greater expedition be bent, extended, mooued to the sides and circumflected or turned about.

The necke.

Vnder the head is the necke of the thigh called *αυχὴν Cernix*. [tab. 23. Fig. 1, 2, 3, D] It is long and reaching vpward, reclined also obliquely inward, least the thighes motion should haue beene hindered. Out of the necke where the bone groweth broader [vnder D] doe arise two knots which they call processes, or *Trochanters*, or *Rotatores*: and these *Trochanters* haue *Appendices* [Tab. 23. fig. 3. the middle x] which in children new borne (as also the head it selfe) may easily be separated, but in growne bodies they are so vnited with the prominent parts [fig. 2. Q with v. fig. 1, 4 with b] that there remaineth scarce any signe or footstep of an Appendix.

The vpper of these [Fig. 2, Q v] is the greater, and of all the processes in the body which are not ioyned to another bone simply the greatest: it bendeth vpward and outward. The lower [Fig. 1, 2, 4] is farre lesser and looketh backward and inward. And both these are called *Rotatores*, eyther because they were made to turne the Thigh, or rather because the muscles which accomplish the motions of the Thigh are inserted into them. The first is called the great Trochanter and *γλουτοῦ*, eyther because it is something like the Buttocke, or because the muscles of the buttocke are inserted into it. The other is called the lesser Trochanter. These two processes are ioyned together by a line which buncheth out behind and runneth from without inward and so the bone of the Thigh becommeth round.

The vse of the Trochanters.

The vse of these Trochanters is like a little hill to admit the insertion of some muscles and to others to afford place of originall, for into the inner Trochanter is infixed the tendon of the first and second muscles which bend the thigh: close vnto this there runneth a rough line [Fig. 2, c c] obliquely downeward and backward which seemeth to bee parted into two and to reach vnto both the heads, but is more evidently terminated at the vtter head, and into this line is the eight muscle of the Thigh implanted adhering verie closely thereto, for by the helpe of that muscle especially we stand vpright.

The sinus of the thigh.

At the vtter proceffe there is a *Sinus*, certaine impressions, and a line to bee obserued. This Sinus [Fig. 2, x] regardeth the head of the Thigh, and into it are the ninth and tenth muscles of the thigh inserted. The impressions are foure at the vtter gibbous part which receiue the Tendons of foure muscles. The first in the backward and lower side; [Fig. 2. Q] it is a large impression which receiue the tendon of the first muscle of the thigh; [fig. 1, τ] in the fore side which is also the rougher and receiue the tendon of the second muscle; the third in the vpper and vtter part [Fig. 1, β below τ and υ] which is gibbous and made to receiue the tendon of the third muscle: the fourth [Fig. 1, and 2, υ] is in the very tob of the proceffe and narrower then the rest, and admitteth the tendon of the fourth muscle. But from the roote of this proceffe on the anterior and the exterior side ariseth the scauenth muscle of the head. The line wee spake of is rough and runneth from the first impression downward and somewhat obliquely through the backside of the thigh, and into it is the first muscle of the thigh implanted.

The line.

Now below the middle Region the Thigh as it descendeth [Fig. 2, from d to e] it becommeth thicker, is dilated and depressed, [Fig. 2, e] in which depression a veine, an artery and a nerue do securely run, and at length it determineth into an ample and broad head; which latitude is made by a large Appendix. [tab. 23. fig. 3. x y the lower] Out of the backside of this head are produced two processes as it were two other heads, [Fig. 1, and 2, E F] betwixt which there is a large space left about an inch broad, [Fig. 2, I] which receiue a protuberation swelling out of the head of the Leg-bone.

The lower heads of the thigh.

These two heads are on the outside rough, but their superficies is smooth, because of a gristle which compasseth them to make the motion at the knee more expedite or easie. These heads doe bend more backward, and in the sides are scarce depressed at all, because of the articulation of the Thigh with the Legge-bone. [ioyne tab. 23. fig. 1, and 2. E F I with tab. 24. fig. 7, G F] which is made by *Ginglymos*, for these two heads of the Thigh doe fit in two bosomes or cauities of the Legge-bone, and the protuberation of the Legge-bone which swelleth vp betwixt his sinus [tab. 24. fig. 7. I betwixt G and F] is receiued by the posterior sinus of the Thigh-bone. [tab. 23. fig. 2, I] Moreouer the Thigh is fastned with the Legge below (as it was aboue with the Hip-bone) by a strong ligament produced from the protuberation of the Leg-bone.

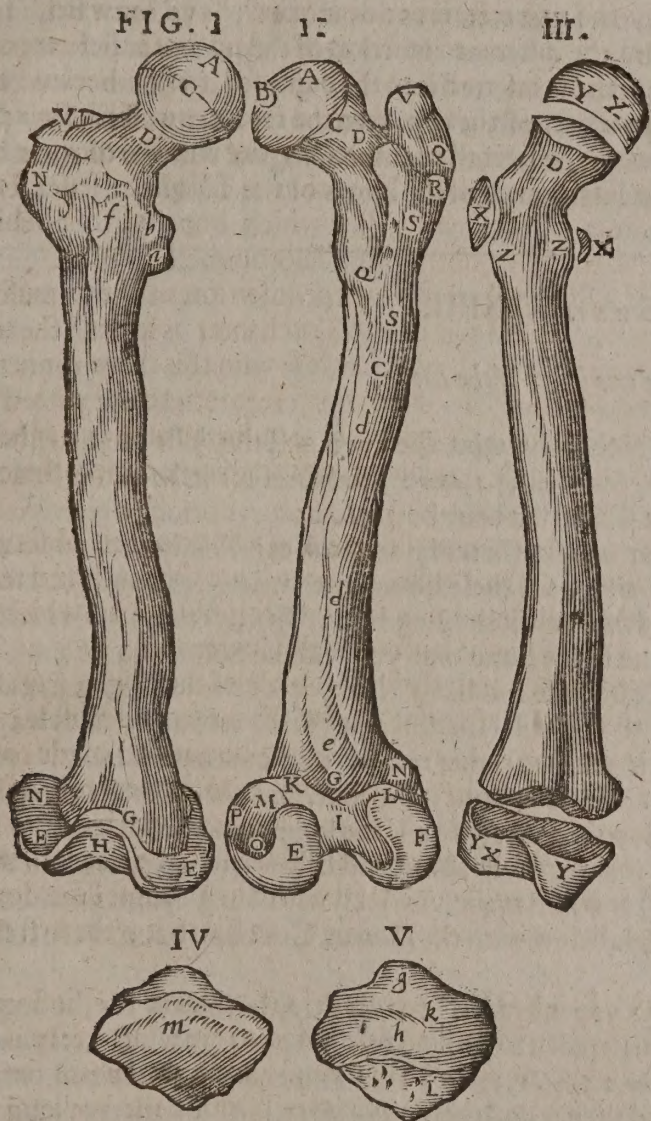
Of these heads, one is internall which is the thicker; another externall which is broader and more depressed, least both of them should bee equally articulated to the Legge and

Table 23. Figure 1 and 2 sheweth the fore and hinder part of the thigh-bone.

Figure 3 sheweth the thigh, whose Appendices wee have remooved out of their place, and disioyned with a little distance.

Figure 4 and 5. The fourth sheweth the anterior and rough side of the Pattell bone; the fift his posterior part crufted over,

TABVLA XXIII.



2, The largeness of the thigh in this part. *f* 1, a roughness from which the eight muscle yssueth. *g*, *h* 5, a knob of the Whirle-bone going into the sinus marked with *l*, which is betwixt the heads of the thigh. *i* 5, a sinus fitted for the inner head of the thigh. *k* 5, a sinus agreeing with the externall head of the thigh. *l* 5, The lower a sperity or roughness. *m* 4, The foreside of the pattell or whirle-bone rough or vnequall.

and so the oblique motion made by the muscle of the Ham called *Popliteus* bee interrupted; for this muscle yssueth from the externall head where it is exasperated with small cavities, and these heads (as he saide) doe enter into the sinus of the Legge-bone. From these processes as it were, the three first muscles that mooue the foote take their Originall, as also the tendon of the fift muscle of the thigh is infixed into the side of the inner head, [*M*] where the compressio is marked. [*fig. 2, R*] Their sides are full of blind holes, out of which doe yssue the Ligaments which hold together the ioynts of the knee.

They haue also foure sinus or cauities, two in the middle of the head, and one in the sides on either hand. The first of these which is the forward [*tab. 23. fig. 1, H*] is crufted over with a gristle and receyueth the protuberation of the Pan: [*Fig. 5, g b*] the second and the backward. [*Fig. 2, l*] is deepe, rough and vnequall, and receyueth the protuberation of the Leggs

A 1, 2, The head of the thigh going into the Cup of the Hip-bone.

B 2, A sinus in the head of the Thigh, into which is inserted a round Ligament.

C 1, 2, The coniunction of the Appendix of the thigh with the bone it selfe.

D 1, 2, 3, the necke of the thigh.

E, F, the two lower heads of the thigh.

G 1, 2, The coniunction of the lower appendix.

H 1, 2, A sinus betwixt the two heads of the Thigh.

K 2, A part of the lower head of the thigh from whence the first muscle of the foote doth proceede.

L 2, Another part from whence the second and third Muscles arise.

M 2, Another part to which the Tendon of the fift Muscle of the thigh is infixed.

N 1, 2, A sinus of the outward side of the head for the fourth muscle of the legge.

O 2, A sinus of the inside through which the tendons doe passe.

P 2, A protuberation at which the sayd tendons are reflected.

Q 2, the vtter processe of the thigh, and betwixt *Q* and *D* is the sinus.

R 1, 2, the vnion of the processe with the thigh.

S S 2, a rough line from the impression of the externall processes.

T 1, the anterior impression of the internall processes.

U, betwixt *T* and *V* another impressio higher then the former.

V 1, 2, the fourth impressio in the toppe of the processe.

X 3, Foure *X*, shew the foure appendices of the thigh.

Y 3, Three *Y* shew the three heads of the thigh.

Z Z 3, Two processes of the thigh.

a 1, the interior processe of the thigh.

b 1, the coniunction of the processe with the thigh.

c c 2, a line descending obliquely from the inner processe.

d d 2, a line running thorough the length of the thigh.

leg-bone: [tab. 24, fig. 7, I] the third is at the outside of the head, [fig. 12, N] through which the tendon of the fourth muscle of the Legge (reflected in this place) is safely transported: the fourth Sinus is at the inner head [fig. 2, O] wherein the tendons of the first, second, third and fift muscles of the legge are safely conuayed.

On the forefide at the roote of the necke the thighbone is large and rough, [fig. 1, f] so framed for the originall of the eight muscle of the Legge: on the backside it buncheth out with a rough and vnequall line [fig. 2, dd] into which the fift muscle of the thigh is infixed.

The vse of the thigh.

Finally, on the outside throughout the length of the bone there is a large sinus or cavity made not so much for lightnes as to containe greate store of marrow for nourishment, and therefore the vpper part of the bone, but especially the lower, is thrilled through with many small perforations whereinto the veynes are admitted which bring blood vnto that place. The vse of the thigh is for progression; now some creatures doe moue right vp, some bending downeward, and this variety is made by the different insertion of that round and strong ligament which yssueth out of the Thigh and is inserted into the cup; for if the insertion bee made, saith *Archangelus*, toward the vpper part of the cup, then the creature walketh streight vp as a man doth; if it bee inserted toward the laterall part, then his gate is prone or inclined to the earth, as an Oxe or an Horse. And thus much of the bones of the Thigh.

CHAP. XXXIII.

Of the two bones of the Legge.

The names of the bones of the legge.

 We call all that the Legge which is betwixt the knee and the instep, and it hath two bones as the Cubit had, [tab. 24, fig. 1, and 2] and surely if it had consisted of one thicke and great bone it would not haue beene so fit for motion, which would haue beene hindered by the gravity or weight thereof, as *Galen* excellently sheweth in the 13 chap. of his third Booke *De vsu Partium*. Of these bones the inner is called *ἡνίκον*, *Tibia*, carying the name of the whole, and so we call it the Leg-bone, [fig. 3, 4] the vtter is called *ἡνίκον* *Fibula*, [fig. 1, and 6] we call it the Brace bone or if you will the Shinne bone.

The Leg-bone is called *Tibia*, haply because it is like a Fluite, it is called also *Canna maior*, for so also a Fluite in latine is called. If you will (for difference sake) we may call *Tibia* the Shanke, and *Fibula* the Shin-bone, or if you had rather retaine the latine names call *Tibia* the Leg-bone and *Fibula* the Brace bone. The Leg-bone is the inner and the thicker, somewhat shorter then the Thigh to which it is ioyned, otherwise it is the longest of all the bones.

His sinure.

The figure of it is long and three square, thicke aboue and below and eeked with an Appendix. [tab. 24, fig. 1, and 3, ABDD] It is also made vnequall with long cauities and lines, and is articulated aboue with the Thigh, below with the *talus* or Coccoal, or bone of the instep by *Ginglymos*.

His vpper part

The vpper part which they call the vpper head is broader then the lower, for the Legge was made to beare the Thigh, and this bredth is formed by an Appendix which is set like a cup vpon the head of the bone. [tab. 24, fig. 1, 3, AB] This Appendix is thicke and before inclineth something more downward then it doth behind; [fig. 1, 3, B] it hath two long Sinus, [fig. 2, and 7, FG] which are but shallow and crufted ouer with a slippery Gristle where into it receiue the two heads of the thigh, [ta. 23, fig. 2, EF] and so a *Ginglymos* is made. But because the proper cavity of these Sinus was not deepe enough to receiue the length of the heads of the thigh, an amends is made and the Sinus increased in all creatures by a peculiar gristle [fig. 8] like a halfe moone, which is therefore called *Cartilago Lunata*, the *Crescent Gristle*; and this gristle is fastned by ligaments. This gristle is moouable and thicke in the circumference or Verge, [fig. 8, N] and yet toward the Center it is alwayes attenuated, [fig. 8, OO] toward the Center I say, for it doth not reach so farre as to the Center but endeth on eyther hand into sharpe tops, [fig. 8, PP] yet so, that before these tops doe meete (for the right is ioyned to the left) but behind they are more distant to giue way to a thicke ligament that passeth betwixt them. The gristle also is slippery, smooth, and soft, full of an vnctuous or oily humor to further the motion of the ioynt, and it supplyeth the office of a ligament.

His gristle.

These two Sinus are separated by a rough and vnequall protuberation [fig. 7, HIK] growing out of the middle superficies of the leg and shank-bone, which protuberation is receiued by the Sinus of the thigh [tab. 23, fig. 2, I] which is betwixt his two heads. Out of the

the rough and sinuated top [tab. 24. fig. 2, 3, 4, 7 I] of this protuberation on the backside yssueth [tab. 24. fig. 2 4 7 K] a strong Ligament which is infixed into the middle of the sinus of the thigh, [tab. 23. fig. 2 I] that the ioynt being thus on euery side defended, might the better be contained in his owne place. From the anterior part of the protuberation [tab. 24. fig. 7 H] which is rough and sinewated, are produced certaine Ligaments which on the foreside of the protuberation doe ioyne the gristles together which encrease the cauities of the shanke, [fig. 8 LM] although also they grow together by the interposition of that orbicular or round Ligament which compasseth the knee.

Out of the Appendix at the vtter side of the legge ariseth a little head [tab. 24. fig. 4 R] ^{His Head.} which is crufted ouer with a gristle and entereth into the vpper sinus [fig. 5, 2] of the Appendix of the Brace or shin-bone, so the anterior part which is next to the appendix [tab. 24. fig. 1, 3, 7 ab] is rough and full of holes, whereinto the tendons of the Muscles that moue the legge are very strongly inserted.

From hence the Leg-bone is by degrees attenuated, diuersly also distinguished with lines and cauities, and imitateth the forme of a triangular; for it hath one corner like a long and sharpe edge which is situate in the forepart; the second corner is in the Vtter part, the third in the inside; and betwixt these angles the bone lies plaine but lightly excauated, as well to make it more light, as also for the insertion and originall of the Muscles. On the backside it is round.

The anterior part and the middle is produced or lengthened vnto an acute and long angle, [tab. 24. fig. 1 3 γγ] which angle is as sharpe as the edge of a knife, and therefore it is called *spina tibiae*, the spine of the Legge by the best Anatomists.

The second line [tab. 24. fig. 1, 2, 3, 4, 9] which maketh the vtter angle of the backside is also sharpe, and is seated vnder the Brace: this line receiue the Ligament which fastneth the shin and the shank-bones together. ^{His Lines.}

The third line [fig. 1, 2, 3, 4, 11] which maketh the internall angle of the backside is blunt and almost round. Wherefore these lines do make the three sides of the Legge. The first side [fig. 1, 3, 2] is sinuated but plain, and together with the side of the Brace [fig. 1, 5, 2] it affoordeth a place vnto the anterior muscles which descend vnto the foote. The second side [fig. 1, 3 11] is inner and gibbous which by some is called *αντικνημιον*, by some *κνημιν*, in a contrary Sense, because it hath no flesh at all, although the other sides especially behind be very fleshy. The third side [fig. 2, 4, 9] the posterior muscles of the Thigh do occupie, and in it, aboue wee meete with another rough line running obliquely downeward [fig. 2, N] [fig. 4, 2] made for the insertion of the muscle of the Ham.

On the outside aboue the lower head there is also a long sinus which runneth backward, ^{His Sinus.} [tab. 24. fig. 4. 10, 5] which receyueth the interior part of the head of the brace-bone which is a little rough, [Fig. 5, 6, 11, 7] and so the Brace and the Leg or the shin and the shank are ioynd together; but where these bones are conioyned there commeth a strong Ligament betwixt them, which fasteneth them together both in the circumference, and where they touch one another. So also behind it is depressed [Fig. 2, 4, m] and sheweth as it were three sinus which conuay the three Tendons of the fift muscle of the foote, and the two benders of the toes, for these muscles run out vnto the foote.

The lower part of the Legge or the lower head is thicke, which for all the appendix ^{The lower part of the leg.} that is added and the plentifull gristle wherewith it is crufted ouer and made broader is notwithstanding lesser then the vpper, whose Appendix together with the Appendix of the Brace, do make in the surface a large sinus [Fig. 9, defgh] which receiue the *Talus* [tab. 25, Fig. 3, 4, 5, 6] or the Coccalt-bone: but in the appendix of the Leg-bone there is as it were a double sinus [Fig. 9, 10, e f] distinguished by a swelling knot which buncheth lightly in the middest betwixt them. [Fig. 7, 10, d]

It hath also a thicke processe yssuing from the inside, [tab. 24. Fig. 1, 2, 3, 9, 10, i] which processe in that part that regardeth the sinus, [Fig. 9, g] is hollow, smooth and crufted ouer with a gristle whereby the cavity is enlarged, and by that meanes it receyueth the *Talus* more commodiously, for that being inserted into the Sinus it cannot bee moued out of his place. The other side of the processe which regardeth the other Legge is gibbous and without flesh. [Fig. 2, 3, 9, 10 i] But in the opposite part the Legge could not haue had another processe, because it was necessary that in it there should bee a long sinus, into which a part of the Brace-bone was to enter.

This processe is by degrees dilated and determineth into two browes, wherefore also the

Table 24. sheweth the bones of the Legge and the Brace, together with the gristles about the knee.

Fig. 1 and 2. sheweth the right Legge whole, both the fore-part and the back-part.

Fig. 3 & 4. sheweth the foreside and the backside of the Leg or Shanke-bone.

Fig. 5 & 6. sheweth the foreside and the backside of the Brace or Shin-bone.

Fig. 7. sheweth the vpper part of the Shanke-bone to which the thigh is articulated.

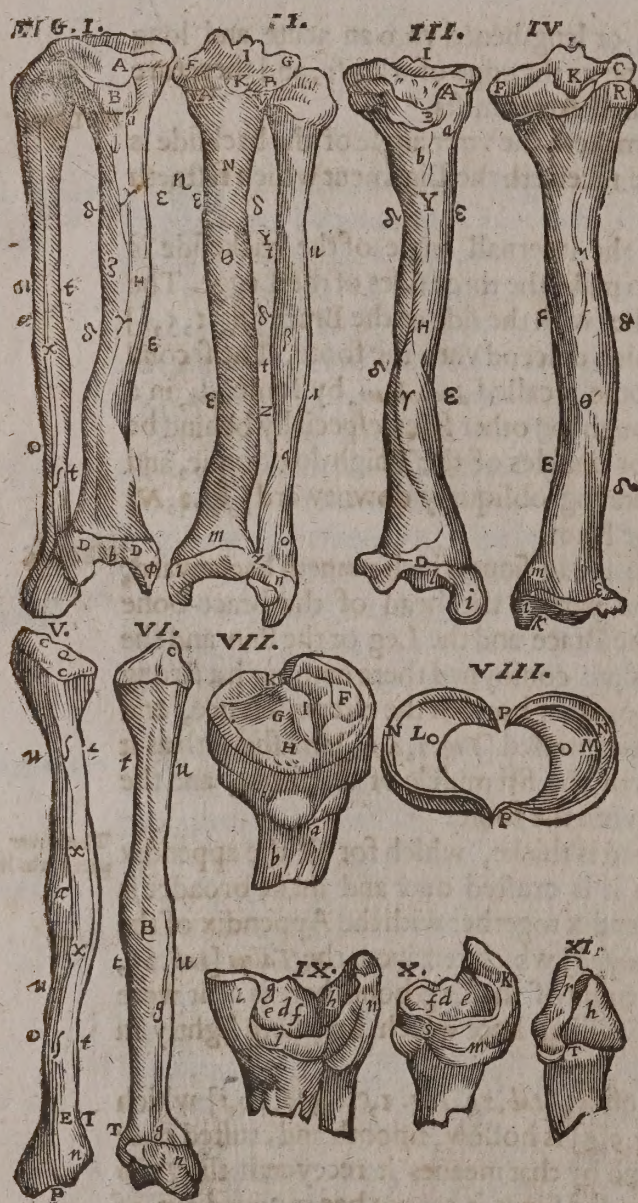
Fig. 8. two gristles increasing the cavity of the ioynt of the Leg-bone at the knee.

Fig. 9. the lower part of the whole Leg where on the foreside it receiveth the Talus or the Instep.

Fig. 10. the backpart of the lower end of the Leg-bone.

Figure 11. sheweth the inside of the lower end of the Brace or Shin bone where it is articulated with the Talus or Instep.

TABVLA XXIII.



eight muscles of the foot are reflected. *rr* 2, 6, 11, a *sinus* of the appendix of the shin-bone from whence goeth a ligament into the instep. *ss* 1, 5, the first line of the shin-bone. *tt* 2, 5, 6, the second line of the shin-bone. *uu* 1, 2, 5, 6, the third line of the shin-bone. *xx* 1, 5, the first side of the shin-bone bunching a little out. *aa* 1, 5, the second side of the shin-bone. *bb* 2, 6, the third side of the shin-bone. *yy* 1, 3, the first line of the Leg-bone. *sss* 1, 2, 3, 4, the second line of the Leg-bone. *ee* 1, 2, 3, 4, the third line of the Leg-bone. *zz* 1, 3, the first side of the Leg-bone. *nn* 1, 3, the second side of the Leg-bone. *θ* 2, 4, the third side of the Leg-bone. *N* 2, 4, a rough line of the third side of the Leg-bone made for the muscle called *Popliteum*.

AB 1, The vpper Appendix of the Leg or shanke-bone.

AB 2, 3, The line where the Appendix ioyneeth with the bone.

C 1, The vpper appendix of the Brace-bone.

C 5, The coniunction of this appendix with the bone.

DD 1, the lower appendix of the Leg-bone.

D 3, the coniunction of this appendix with the bone.

E 1, the lower appendix of the Brace or shinbone.

FG 2, 4, 7, the bosomes of the bones of the Leg receiuing the heads of the thigh bone.

HIK 7, A protuberation which is betwixt these cavities; *KL* in the second, third and fourth figures doe shew the same.

LM 8, a gristle increasing the outward cavity of the Leg-bone *L*, another increasing the inner cavity *M*.

N 8, the foresaide gristles do in this place appeare thickest.

O 8, and here they appeare thinnest.

P 8, here they do determine into sharp points.

Q 5, A shallow *sinus* of the Brace bone to which the head of the leg-bone is articulated.

R 4, the head of the Leg-bone which is ioyned to the Brace.

S 4, 10, A *sinus* of the Leg-bone receiuing the lower end of the Brace bone.

T 5, 6, 11, the inside of the Brace where it is ioyned to the bone of the Leg.

V 2, the context or coniunction of the Brace with the Leg-bone above.

X 2, the same coniunction below.

Y 2, the distance betwixt the shanke & shinbones.

Z 1, 2, The oblique turning of the Brace inward which on the outside is somewhat indented.

ab 1, 3, the forepart of the Leg-bone whereinto the muscles which extend the Leg are inserted.

c 5, 6, the vpper proceffe of the Appendix of the Bracebone, whereinto is inserted the tendon of the fourth muscle of the Legge.

d 5, 6, 9, At this place the vpper part of the *talus* or instep is articulated: in the ninth and tenth figures *d* shew the vpper region; but *d* noteth the protuberation.

h 9, 11, the outside where it is fitted with the instep the inner ankle or a proceffe of the inner appendix of the Legbone.

i 2, 3, 9, 10, the inner alkie.

k 4, 10, a *sinus* of the inner ankle from whence a gristly ligament is inserted into the instep.

l 1, 3, 9, an vnequall *sinus* in the lower appendix of the leg-bone, whence groweth a gristly ligament which is set vnto the necke of the instep.

m 2, 4, 10, certaine *sinus* through which three tendons are led to the foot. *n* 2, 5, 6, 9, the outer ankle or the proceffe of the shin bone in the first figure noted with *E*.

op 1, 5, that part of the shin-bone which is bare. *qq* 2, 6, in this sinuated place of the shin-bone the tendons of the seauenth and

This

the shinne-bone or the *fibula* departeth into a proceffe, that so the bone of the *Talus* might be contained or kept in by both the processe, that it should not slippe out on this side nor on that side. And if at any time the luxation of the *Talus* doe happen, it is rather to the inner processe then to the vtter, because the processe of the *Brace-bone* is lengthned out somewhat longer then the other.

These processees are called *malleoli* the Ankles, the processe of the Legbone is called the inner ankle, and the processe of the *Brace-bone* is called the vtter ankle.

The inner Ankle [figure 1, p. fig. 2, 3, 9, 10, i] in the lower end the backpart hath a rough *sinus* [fig. 4, 10 k] whereout yfflueth a gristly ligament whereby the bone of the leg is fastned to the *Talus*, so likewise in the lower and fore side [fig. 1, 3, 9, i] of the appendix there is a *sinus* rough, transuerse and long, from whence groweth a ligament which fastneth the necke of the *Talus* [ta. 25, fig. 3, N] to the leg-bone.

Finally, this bone as also the *Brace* is notably hollowed within, and that cavity conteyneth the marrow, neither is it without other perforations. The vse of the Leg-bone saith *Archangelus*, is to make the progression more expedite and nimble. And thus much of the Leg or Shank-bone.

Of the Brace or Shin-bone.

The other bone of the Legge is called *fibula*, because as in buildings those Irons whereby the beames and pannes are ioyned together are called *fibula* or *braces*, so this lesser bone may also bee well called the *Brace*, because it ioyneth together the muscles of the Legge: it is also called *cannamini*, and in English if you will the Shin-bone. It is seated on the outside of the Leg as the wand is on the outside of the Cubit; aboue it entreth into a plaine and crufted *sinus* of the Leg-bone [fig. 5, 2] vnder the head thereof [ta. 24, fig. 1, C vnder A] below it entreth into a long *sinus* of the Legge. [Fig. 1, from E to D] At both the ends it is articulated by *Arthrodia* or *adarticulation*, whose motion is obscure. In the midst the two bones doe stand off one from the other [Fig. 2 T betwixt V and X] that so the muscles of the foote might finde place between them especially in the vpper part, because there the Leg is bent into a *sinus*. In this distance there is a membranous ligament which fastneth the skinne and the shanke-bone together. The length of the *Brace-bone* is equall to the length of the other; for although aboue, it do not ascend into the knee, yet belowe it descends lower then the shanke-bone, but in breadth and thickenesse it commeth farre short. Moreouer a little vnder the middest it is somewhat curued toward the Legbone, and the outside is after a sort concauous, [Fig. 1, 2, Z] yea to say true, the figure of it is not much vnlike the figure of the Leg-bone it selfe.

It hath two heades, one aboue and another below whereto there groweth an Appendix which endeth into an acute processe somewhat exasperated. The vpper of these is below the head of the shanke-bone, [Fig. 1, C vnder A] which is defended with an Appendix and crufted ouer with a gristle: it is round, and on the outside swelleth very notably, [Fig. 5, b c] the better to receiue the tendon of the fourth muscle of the Legge, as also to giue an originall vnto the head of the seauenth muscle of the foote. The Appendix of this head hath on the inside a large and ample *sinus* [Fig. 5, Q] crufted ouer with a gristle whereto the head of the Appendix of the Leg-bone is articulated [Fig. 4, P.]

The lower head tendeth into a sharpnesse [fig. 1, E] and descendeth so much lower then the Leg-bone, as the head of the leg-bone ascended aboue the *Brace* in the top; it is also furnished with one appendix [Fig. 1, E 2, 5, 6, 9, n] which growing thick departeth with a processe called the outward ankle, which descendeth somewhat lower then the inner ankle and maketh the externall side [Fig. 9, 11. h] of the common *sinus* [Fig. 7, defgh] which receiue the *Talus* or bone of the instep, and is crufted ouer with a gristle. This ankle is lower then the inner, and on the outside gibbous, some part of it also may bee felt without flesh, and from it some muscles of the foote (properly so called) take their originall; on the inside it hath a rough *sinus* [Fig. 2, 6, 11, r] out of which ariseth the gristly Ligament which fastneth the *Brace* or shin-bone to the instep. Aboue the Ankle there is a *sinus* [f. 2, 6, q] couered with a transuerse Ligament; where vnder the tendons of the sixt and seauenth muscles of the foote are safely conuayed.

Betwixt these two heades of the body the *Brace* or shin-bone is vnequall, because of cauities and lines therein made for the insertion of muscles: so that about the middle it seemeth to be triangular; for before there appeareth an acute and swelling line, [f. 1, 2, ff] behind it is depressed and hath on either hand a strutting line, [fig. 1, 2, 5, 6. ttvv] and these lines

lines make the three sides of the *Brace-bone*. [fig. 1, 5, 2, 6. ^β] In like manner at the lower end about the appendix [fig. 5, 6, 117] there buncheth out an asperity, at which place by the interposition of a ligament it is fastned to the shanke or leg-bone:

The vse of it.

The vse of the *Brace-bone* is threefold: the first to ioyne the Leg and the Instep, whereby the foote is bent and extended: secondly to defend the vessels and muscles of the Leg from outward iniuries, for the *Brace-bone* couereth for the most part the course of them all. Thirdly, to sustaine, strengthen and secure the Legge by fastening it to the outward head of the Thigh-bone. Moreouer, as the Wand helpeth to moue the Hand, so the *Brace-bone* helpeth to moue the Foot in compasse, saith *Archangelus*.

CHAP. XXXV.

Of the whirle-bone of the Knee.

The names of the whirle-bone.



Efore wee part from the Leg, you must remember that there is a bone placed before the ioynt of the Knee [tab. 23, fig. 4: and 5,] which the Grecians call *ἐμπροσθεν* and *ἐμπροσθεν*, because it lieth vpon the Knee; others call it *μύλον*, the Millstone, because it is very like it. *Celsus* calleth it *patella* or the *Sawcer*. It is also very commonly called *Rotula*, we will call it the Whirle-bone.

How it is fastned.

It is a bone common to the Thigh and the Leg although it be separated from them both, for it is placed before their articulation. In each knee there is one, somewhat round and broad and ending into a sharpnesse where it resteth vpon the Leg. The magnitude of it is moderate, the latitude scarce two fingers broad, the longitude is somewhat thereabouts, the thicknesse is vnequall, for in the extremities it is thinne and growes thicker by degrees, so that in the middest it buncheth out like a compassed buckler, or if you will, like an embowed Looking-glasse such as they vsed in ancient times. The vpper part thereof groweth to the thicke Tendons of the seauenth, eight and ninth muscles of the Thigh, which by the knee doe runne vnto the Leg: by these Tendons it is established, for they serue it in steade of a Ligament to fasten it both to the Thigh and to the Leg: moreouer on the outside it is couered by them; on the inside it is cruisted ouer with a smooth and slippery gristle, at least the greatest part of it, especially where it regardeth the Thigh, and this gristle maketh the motion more glib, for it will easily moue vnder a mans finger. *Columbus* cannot taste this conceit, but sayeth that it is fastened both to the Thigh and to the Leg by Ligaments of his owne, which sayeth hee doe grow from the *Appendices* of the Thigh and the Legge, so also sayth *Archangelus*, yet he doth not deny but it is established by the Tendons of the muscles before spoken of. But *Bauhine* leaneth more to the first opinion of *Vesalius*, that it hath no other Ligaments but the Tendons. If these Tendons to which it groweth be cunningly taken away, it will appeare both before and in the sides [tab. 24, fig. 4] rough and full of blind holes, but behinde it hath a moderate protuberation [fig. 5, gh] and shallow bosome on either side [fig. 5, ik] cruisted ouer with a gristle, of which the vtter is the larger and the broader.

His articulation.

This protuberation wee speake of, is receiued by the *sinus* which is betwixt the heads of the Thigh, [fr. 1, A betwixt EF] like as the bosome of this whirlebone receiueth the heads of the Thigh, wherefore the Thigh receiueth the whirle and the whirle the Thigh, and so are ioyned by *Ginglymos*; but the whirle and the Leg-bone are ioyned by *adarticulation*: wherefore it is mouable least it should make the motion of that ioynt difficile or hard. Moreouer the inner and lower part [fig. 5, L] where it groweth into a proceffe and regardeth the vpper part of the Legge-bone, is rough and perforated, that it might growe the faster to the Tendons of the foresaid muscles.

The substance of the whirle is at the first gristly and so remayneth for certaine months. Afterward it groweth as hard as a hard Appendix, and at length bony, hard and solid, such as it appeareth in growne bodies, so saith *Falopius* in his obseruations, and with him *Bauhine* consenteth; *Columbus* thinketh it groweth not beyonde the height of an hard Appendix.

The vse of it is to couer and to firme the lax and dissolute composition of the ioynt of the Thigh and the Leg, least in progression and walking the Thigh shall luxe outward, as also when we goe downe a hill it might support the ioynt. Moreouer, by the helpe of the whirle when the knee is gathered directly backward, it is bent into a right angle.

Finally

Finally, it defendeth the Tendons of the foresaid muscles, least in the bending of the knee when the thigh bone presseth forward it should beare too hard vpon them; and in a word as the Seede-bones of which we spake before, the hardnesse of it receiuerh the violence of the Thigh-bone, and breaketh it that it should not compresse those Tendons.

CHAP. XXXVI.

Of the bones of the foote properly so called, and particularly
of the Wrest of the Foote.

WE are now come vnto the third and last part of the Foote, which is properly called the Foot, and *Pes extremus* or *Pes parvus*. It hath 38 bones and three parts. The first part is called *Tarsus*, which we call the wrest of the Foote: and hath seuen bones.

The second is called *metatarsus* or *pedium*. the Afterwrest of the Foot, and hath five bones.

The third part is of the Toes, which haue foureteene bones, to which we may adde twelue Seed-bones. Of these in order.

Of the seuen bones of the *Tarsus* or wrest of the Foot: foure haue names, the other three are not so much beholding yet vnto Anatomists.

The first [ta. 25, fi. 1 and 2. and the whole third, fourth fift, and sixth figures] which the Grecians call ἀσπίς, and ἄσπις, the Latines *Os balista* and *Talus*. The pasterne bone lyeth vnder the *Appendices* of the shinne and shanke-bones as a firme and stable foundation, and yet it seemeth to lye onely vnder the shanke, and this bone is not onely found in men but in all other creatures whose feet are diuided into Toes. In the vpper part thereof there is a smooth and round knub [fig. 3, 4, 6, ABCD] crufted ouer with a gristle, which representeth the forme of the nut of a Crosse-bow. The surface also of the knot is as it were foure square, limited about the edges, with foure sides, and therefore by some is called *quatrio*: the first and second of these [fig. 3, 5, 6, from A to B and from C to D] goe through his length: the third is on the fore side [from A to C] the fourth on the back side. [from C to D] In the middle it hath a shallow cavity [fi. 3. EE] with rising sides [fi. 3. FF] like the sides of the furrow of a pulley wherein the rope runneth, by which *sinus* it is coupled be *Ginglymos* with the appendix of the shank-bone. [ta. 24, fi. 9, 10, def] The sides of it are plaine and sloping, crufted ouer with a thinn gristle to receiue the Ankles: the inside [fi. 5, G] is crufted but a little way, and receiues the inner Ankle of the Leg; the outside is broader [fi. 6. H] and more hollowed, descending lower the better to admit the outward ankle of the Brace-bone which also descendeth lower. [tab. 24, fi. 9, 1, 1, b] And thus the *Talus* is ioyned with the Leg and the Brace, which articulation serueth for the right motion of the foote, which that it might more easily performe and without attrition of the bones, it is on both hands crufted ouer with a gristle.

The first bone
of the *Tarsus*.

Furthermore, on the inside it hath a rough *sinus* [fig. 5, I] whereinto a gristly Ligament is receiued which groweth from the inner ankle, and whereby the *Talus* is fastned to the shank. Againe, on the outside [fig. 6, R] there is another *sinus* which receiuerh a Ligament produced from the outward ankle. Moreover, on the back side at the root of the protuberation where it is ioyned to the Leg and the heele [fig. 5, after BD] there is a roughnesse, partly to receiue the ligaments which grow from the Leg, partly to reach other ligaments vnto the heele. There is also in the back part [fig. 5, 6, LM] a *sinus* prepared for the transition of the tendons of muscles which attaine to the sole of the foote.

Yet further, this first bone is not onely ioyned with the shinne and the shanke, but also with the *Boate-bone*, and therefore the forepart of the *Talus* is lengthned into a long necke, [fig. 3, 4, 5, 6 N] and the necke endeth into a round head [O] couered ouer with a slippery gristle which is receiued by the large and round *sinus* or bosome [fig. 11, K] of the *boate-bone*, and by the meanes hereof the foote is moderately and with an oblique motion moued inward and outward, and something also in compasse.

At the Heele also this *pasterne-bone* is fastned with a double ioynt, and therefore the lower part thereof hath on the back side a large and deepe *sinus* [figure 4, 2] couered ouer with a gristle, into which the large and broad head [figure 7, 8, 9, P] of the heele-bone is inserted: before it hath a long and smooth protuberation [figure 4, S] which is receiued by a long bosome [Figure 7, 8, 9, R] on the back side of the heele. Betwixt these two spaces or in

the

the middle of these ioynts there is a deepe and rough cavity [fi. 4, TT] whereto the sinus of the heele [fig. 7. 8. 9 R] is opposite and answerable; the vse of which cavity is to containe a mucous substance and fat withall, whereby these bones are moystened that they should not grow dry by perpetuall motion. Moreover in the same cavity doe grow these gristly ligaments which in this place doe very strongly binde the pasterne bone to the heele, and therefore when the bones are cleansed and afterward fastened together, there remaineth in this place a great distance. Sometime also on the backside it is extended above the heele where it bends inward as it were into a double small proesse. It hath no appendix, for it hath need of equall strength on euery side; neither receiuerh it the insertion of muscles, neither doth it offer originall vnto them.

The substance of this bone in the originall, as also of all the other bones of the wrist of the foote excepting the heele is a gristle, but in growne bodies it is on the inside fungous, yet where the proesses breake forth, solid and dense, saving that it is perforated manifold.

The second
bone of the
wrist.
The heele.

The second bone of the wrist [fig. 1, and 2, and the whole seven, eight and nine figures] is called in Greeke *καλκάνιον*, *Calx*, *calcaneum*, *pedis calcx*, in English the Heele. This is the greatest and the thickest bone of the whole foot properly so called, and was so made for more strength and firmitude. For the extension and flexion of the foote are made by the articulation of the *Talus* or pasterne bone to the bones of the Leg and the brace. Again, the motion of the foote to the sides, is wrought by the coniunction of the *Talus* to the boat-bone; the rest of the connexions of the Bones which are many and small doe little assist the former.

His vse.

As therefore the *Talus* or pasterne bone is the principall agent in the motions of the foot, so is the heele the principall firmer and establisher thereof. And vnlesse the heele had beene greater then the *Talus*, not onely the pasterne it selfe, but the shanke also would slip backward, for it lyeth directly vnder the shanke and almost alone supporteth it, and by it the Thigh, and by the Thigh the whole body. It was therefore very necessary that it should be a notable large bone, or else Nature had beene very improuident to lay so great a weight vpon it. It behoued also that his articulation should be very firme, not wauering or vnstedfast, and therefore Nature ioynd his proesses with many hard, gristly, broad and round ligaments, not onely to the pasterne bone but also to other bones neare adioyning to make his strength more assured. Wherefore it doth not onely lye vnder the *Talus* and sustaine it, but is also articulated thereto and to the cube. To the *Talus* the vpper part of his large head [Figure 6, 8, 9 P] entring into the sinus of the *Talus* [Figure 4, 2] and againe the heele admitteth into a narrow and almost plaine sinus of his owne [Figure 7, 8, 9, R] the protuberation of the *Talus*: [Figure 9, S] to the Cube-bone it is ioynd on the fore side [Fig. 11 R] by his depressed head. [Figure 7, 2]

The lower part of the Heele [Fig. 2, XYZ] is somewhat broad that the foote might stand more safely; rough also and vnequall because of the muscles. It hath a rough [Fi. 2, y x Fig. 8, y Fig. 9, z] and transuerse proesse running from behind downward, from whose fore side ariseth the muscle which bendeth the second bones of the foure Toes, and the fleshy portion, from which are produced the muscles which leade the foure Toes to the great Toe: wherefore within the proesse there is a cavity least when the foot is fastened vpon the ground, the heads of these muscles should be compressed.

The head of the heele or the vpper part thereof in children hath an Appendix, and is like a round body, hauing a light impression raised with a little ruggednesse [figure 7. 8, 9. ab] into which impression the Ligaments of the shanke bone and of the pasterne are inserted. On the backside this vpper part is depressed and rough on either hand, [Fig. 2, 8, 9, c] in which depression and asperity the greatest and strongest tendon of the whole body, that is, of the first, second and fourth muscles of the foote is inserted. On the fore side it hath rough and deepe bosomes, [Figure 7, V V] which with the bosomes of the pasterne are filled with gristles.

The sides of the heele are broad and depressed. The inside [Figure 2, 8, dd] is smooth and notably sinewated; in the middle are three inscriptions [Figure 2, 8, e] to make way for the tendons of the fifth muscle of the foote, and the two benders of the last ioynts, which passe that way vnto the sole of the foote: that way also passe the veines, arteries and nerues, which are also defended by the proesse of the heele which maketh the inside of the heele very deepe.

The

Table 25. Sheweth the bones of the Foote properly so called.

Fig. 1, and 2, shew the bones of the right foote fastened together their upper face and their neather face.

Fig. 3, 4, 5, & 6, shew the upper, lower, inner & outer sides of the Talus or pasterne.

Fig. 7, 8, 9, sheweth the same sides of the Heele.

Fig. 10, and 11, sheweth the forward and backward side of the boate-bone.

Fig. 12, and 13, shew the fore and backpart of the wrist made of foure bones.

TABVLA. XXV.



ABCD 3, 5, 6. The protuberation of the Talus ioyned to the appendix of the leg-bone, and of this protuberation foure sides.

EE 3, A sinus insculped in the protuberation of the Talus.

FF 3, two bunching parts of the protuberation of the Talus.

G 3, the inner side of the protuberation of the Talus crusted ouer with a gristle, ioyned to the inner ankle.

H 6. The outward sinus of the protuberation of the Talus couered ouer with a gristle, and receiuing the inner ankle.

I 5, a rough sinus of the Talus receiuing a gristly ligament from the inner ankle.

K, 6, a sinus of the Talus receiuing a gristly ligament from the outward ankle.

L M 5, 6, two sinus in the hinder part of the Talus.

N 3, 4, 5, 6, the necke of the Talus or pastern bone.

O 3, 4, 5, 6, the head of the Talus going vnder the sinus of the boate bone.

P 7, 8, 9, the head of the bone of the heele crusted ouer with a gristle and going vnder the sinus of the Talus or the pasterne bone.

Q, 4, a large sinus of the Talus receiuing the head of the heele.

R 7, 8, 9, a sinus of the heele whereto the lower part of the head of the Talus is ioyned.

S 4, the lower part of the head of the Talus going into the sinus of the heele.

TT 4, a sharpe sinus of the heele receiuing a gristly ligament from the pasterne bone.

XX 2, the place of the heele.

YZ 2, Y 8, Z 9, a proceffe of the heele made for the production of muscles.

ab 7, 8, 9, from a to b the distance of the vpper part of the heele.

c 8, 9, the hinder part of the heele.

d 2, 8, the inner side of the heele.

e 8, the place where the tendons that run to the bottom of the foote are reflected.

f 7, 8, the viter side of the heele.

g 1, 7, 9, here the tendons of the 7 and 8 muscles of the foote are stretched out.

b 7, the forepart of the heele which is ioyned to the pasterne bone.

7, that part of the heele which is ioyned to the Cube bone.

k 1, the sinus of the Boat-bone receiuing the head of the Talus.

lmn 10, three surfaces of the Boat-bone lightly prominent, which are articulated to the bones of the wrist.

op 11, the vpper part of the Boatbone regarding the top of the foot. q r 10, and q 11, his lower part. q 10, 11, A sinus through which the sixt muscle of the foote is led. s t u 13, the plaine surfaces of the three inner bones of the wrist whereby they are articulated to the Boat-bone. x 13, a shallow sinus of the Cube bone whereby it is articulated to the heele, ab 12, the place of the Cube bone to which that bone of the Afterwrist is ioyned which supporteth the last Toe saue one. y 12, 13, the place of the Cube bone where the third bone of the wrist is articulated, a 12, 13, that part of the Cube bone which respecteth the outside of the foote. e 12, 13 the surface of the Cube-bone in the vpper part of the foote. f 2, 13, that part of the Cube bone which regardeth the earth, u 2, a sinus of the Cube-bone at which the tendon of the seuenth muscle of the foot is reflected. B 13, a proceffe of the third bone of the wrist wherinto the fift muscle of the foot is inserted, i 12, the place of the inner bone of the wrist to which that bone of the Afterwrist which sustaineth the great Toe is coupled. x 12, the place of the second bone of the wrist whereto the bone of the Afterwrist that supporteth the fore Toe is articulated. a 12, the place of the third bone of the wrist whereto that bone of the Afterwrist which supporteth the middle toe is articulated. u 1, 2, a small bone whereby that bone of the Afterwrist which sustaineth the little toe is ioyned vnto the Cube bone. vv 1, 2 the distances betwixt the bones of the Afterwrist. xz 1, 2, the heads of the bones of the Afterwrist which enter into the bosomes of the toes. π, 2, a proceffe of the bone of the afterwrist whereinto the tendon of the seuenth muscle of the foote is implanted. p 2, a proceffe of the Bone of the Afterwrist, which sustaineth the little toe, which proceffe receiue the tendon of the eight muscle of the foot. s, t, u, 1, 2, the three bones of the

the foretoe. 2, two seede bones placed vnder that bone of the Afterwrest which sustaineth the great toe, * 2 vnder X. a seede bone set to the second ioynt of the great Toe. F. 1, 2, the *Talus* or pasterne. Δ. 1, 2 the Heele. Θ. 1, 2, the Boat-bone. Λ, Z. 1, 2, the bones of the toes. ϕ, X. 1, 2, two bones of the great toe. I, II, III, IV, V, 1 the five bones of the Afterwrest, 1, 2, 3, 4. in fig. 1, 2, 12, 13, the four bones of the *Tarsus* or the Wrest. Ch. 1, in fig. 12 and 13, the greater wedgbone or the first bone of the wrest. Ch. 2, fig. 12, 13, the lesser wedge bone or sixth bone of the wrest. Cha. 3, fig. 12, 13 the middle wedgbone, or the seventh bone of the wrest, Cha. 4 fig. 12, 13, the Cube-bone.

The outside [fig. 2, 9 Z] is depressed, rough and vnequall, out of whose lower part yssueth the muscle which leadeth the little Toe from the rest, but in the foreside there is a little sinus [fig. 1, 7, 9 S] crufted ouer with a Gristle, which we meet withall vnder a small proceffe, and through this sinus the tendons of the seventh and eight muscles of the sole do passe and are reflected vnto the backside of the vtter ankle. That part of the heele that is next the little Toe is on the foreside smooth by reason of a gristle wherewith it is crufted ouer, and the vpper part shooteth out a large head raised somewhat high, by which head the heele is articulated into a sinus of the Cube-bone almost plaine, [fig. 1, 2, Θ] below it hath an oblique Sinus bending inward, which receiueth a part of the Cube-bone.

The third bone of the wrest [fig. 10, 11,] is called by the Grecians *σκαφοειδής*, *Nauforme*, *Os Naucular*, *Cymba* the Boat-bone, because it is long, deepe, behind hollow, before and in the vpper part gibbous, [fig. 1, op] in the lower part hollow, [fi. 10, 11 q] This *Boat-bone* is seated in the inside of the foot, and by the mediation therof, the greatest part of the wrest is ioyned to the *Talus*. For on the backward it hath a Sinus [fi. 11, k] deepe and transuersely long, [fi. 1, olmn] in which the head of the *Talus* [fi. 3, 4, 5, O] is inserted, and this articulation must be referred to an obscure *Enarthrosis* or *Inarticulation*, because the motion therof is obscure. The other part hath a long head bunching out, and distinguished with a threefold superficies or surface [fig. 10, lmn] to which the three last bones are articulated, [fig. 1, 2, 12, 13, cha. 1, 2 3,] but because they are very smooth, it is to be doubted whether they receive or are received.

The outside of this Boat-bone is large, round and sinuated [fig. 10, qr and 11 q] especially where it is ioyned to the first bone. Presently after, it is angustated by degrees, and endeth into an internall narrow proceffe [fig. 10, q] resembling the prow of a ship. The inside is prominent, so that it maketh a notable protuberation, which protuberation maketh the lower sinus [fig. 10, 11, q] ouer which it hangeth much greater where the tendon of the first muscle of the foote is reflected. Finally this Boat-bone is rough about and below, that from thence the ligaments might yssue which tye this bone to the *Talus*, and the bones the of wrest of the foote.

These three bones whereto there is nothing answerable in the hand, and are as it were the basis of the leg, the Ancients haue not numbred among the bones of the wrest of the foot. There follow other foure, which (say they) do alone make the *tarsus* or wrest, and are like vnto the wrest of the hand; for being ioyned together by Ligaments, they make as it were an Arch, whose vpper superficies is conuexe, and the lowes concavous or hollow: for the Cube-bone is ioyned to the heele, and the three following to the Boat-bone, and with them are together lifted vp from the earth, for such a construction as this is stronger both for the fastening of the foot and sustaining of the body, for an arched building is more strong and lasting. These bones also were necessarily prominent, that vnder such prominences a cavity should be left, wherein as well the tendons of those muscles should be secured which runne vnder the sole, as also the muscles themselves which arise from the lower part of the wrest, and are directed to the toes of the foote; for if the sole had been plaine, the Muscles with their tendons would haue been compressed, and so neither could a man haue travelled without paine, and besides the muscles had been kept from performing their office in flexion and extension.

Moreouer, where these bones are ioyned one to the sides of another, they are not couered ouer with gristles, sauing onely where they beare vpon the Boat-bone. Otherwhere they are coupled with gristly Ligaments. They are also without *Appendices*, and their substance is like the substance of the pasterne and Boat-bones. They differ also in quantity and figure, [conferre Fig. 1 with 2, and 12 with 13] for the two first are far greater then those two in the middest, and are ioyned to the foure bones of the *Pedum* or Afterwrest, but we will intreat of them particularly.

The fourth bone of the wrest [fig. 12, 13, cha. 4] is called in Greeke *κυβοειδής*, *Os Cubiforme* from the forme of a Dye, because it hath as it were six sides. It is also called *πολυμύρρον*, *Os*

The third
bone of the
Wrest.

The fourth
bone.

Os Multiforme, because it hath diuers formes. This bone on the outside of the foot is placed before the heele. It is greater then the rest and the first side of it [fig. 13, x] is ioyned behind to the heele [fig. 7, i] with an vnequall surface and resteth vpon the ground, and it is doubtful whether it receiue or be receiued. *Archangelus* affirmeth both: the second side, [fig. 12, a, b] before is ioyned with a continual superficies to the fourth and fift bones of the Afterwrest, and supporteth them like a basis; the third side is inward [fig. 12, 13, y] and articulated to the seventh bone of the wrist; the fourth side is outward [figure 12, 13, d] and obscurely plaine, neither doth it ioine to any bone, no more then the two following sides doe, for the fift side is aboue plaine and rough [figure 12, 13, e] and the sixt is below. [figure 2, 3, figure 3, c] Finally, the latter end or extremity of it hath a proceffe diuided by a middle sinus, [fig. 2, n] which is long and oblique, whereat the tendon of the seventh muscle of the foot is resolved.

The fift bone of the wrist [fig. 12, cha. 1, fig. 13, f] as also the two following, are called in Greeke *χαλκοειδής*, *Cuneiformia*, because they are like wedges. This fift occupyeth the inside of the foote, and is seated ouer against the great toe. On the foreside it is sinuated [fig. 13, y] to receiue a portion of the proceffe of the Boat-bone: behind, it receiueth the first bone of the *Pedium* or Afterwrest, and it is vncertaine whether it be sinewated or prominent, which vncertainty is common to the backward bones, as they are coupled either one with another, or with the bones of the Afterwrest, so that they seeme to be conioyned by *Ginglymos*, because they haue obscure Sinus or bosomes, notwithstanding this part seemeth to haue two smal knots or protuberations, because the bone of the Afterwrest carrieth the shew of a double cavity: the vpper part is but small and a little conuex, whereby it is ioyned to a shallow or superficially Sinus of the sixt bone; the lower side is thicker, that it might rest faster vpon the ground.

The sixt bone of the wrist [fig. 12, 13, ch. 2, 7] is called *Cuneiforme minus*, the lesser wedge, and if you regard the vpper part which looketh toward the foote it is broad, somewhat arched, and as it were foure cornered. If you respect the lower part which looketh toward the foote it is very narrow and edged, and so resembleth a wedge, as also doth the seventh which is next vnto it, for they both seeme to be like wedges interposed amongst the rest to ioine them the faster together. This sixt bone behind is ioyned to the Boat-bone; [fig. 13, f] before it lightly buncheth out and it fastened to the second bone of the Afterwrest; [fig. 12, x] on the inside it is ioyned with the outside of the fift bone of the wrist, and on the outside with the outside of the seventh.

The seventh bone of the wrist [fig. 12 and 13, cha. 3, 1] is called *Cuneiforme medium*, the middle wedge, and is seated betwixt the fourth and the sixt. It is somewhat like a Quadrangle but longer, for on the backside it hath a small sinus [fig. 13, u] which receiueth the protuberation of the Boat-bone; on the foreside it admitteth the third bone of the Afterwrest, [fig. 12, y] and the sides of it touch the sides of the sixt and the fourth Bones. And thus it is placed amongst the bones like a wedge; below it swelleth out with a protuberation, [fig. 13, o] whereinto the fift muscle of the foote is inserted.

[The twelfth Figure sheweth the anterior face of the foure bones of the wrist, of the foote fastened together, the thirteenth figure sheweth their backside.]

CHAP. XXXVII.

Of the Bones of the Afterwrest, and the Toes of the Feet.

THE second part of the Foote is called *medior*, by the Grecians, by *Celsus Planta*, the tread of the Foot, by others *peden*, and by others *Metatarsum*, because it is answerable to the *Metacarpium* in the hand, we will call it the *Afterwrest of the Foote*. [tabl. 15, fig. 1, ch. I, II, III, IV, V] It is compounded of five bones which are articulated to the Bones of the *Tarsus* or wrist, and do sustaine the bones of the Toes. To the *Tarsus* or wrist they are ioyned by a somewhat plaine and smooth superficies [fig. 12, 2, x, y, a, b.]

The first which is placed before the great toe, is articulated to the inner bone of the wrist; that which is placed before the next to the great toe is ioyned to the second bone of the wrist; that which is placed before the middle toe to the third, [figure 2 betwixt, w] the other two are articulated to the Cube-bone. [figure 2 neere p and n] And as the bones of the Wrist of the foote are not placed on the foreside in a right line, so of the bones

The fift bone.

The sixt bone.

The seventh bone.

The afterwrist of the Foot.

bones of the Afterwrest one enclineth more backward then another. Notwithstanding, they stand in one order or ranke as do the bones of the Toes, which maketh much to stability and firmitude.

They are long bones and round, and end on both sides into heads. For where they are articulated with the bones of the wrest they are thicke and sinewated and ioyned together by their sides; where they recede, or depart by degrees one from another, they become slender and leaue a distance between them for the Muscles called *Interossei*, which we called the *Bone-bound Muscles*. But their lower heads which are inserted into the deepe bosomes of the first ioyns of the Toes [fig. 1, 2, & in ^o] are orbicular, and on the backside encreased with an Appendix. The heads of these bones are more diuided towards the vpper part and lesse toward the lower, quite contrary to that it is in the hands, and the reason was because in extension it behoued that the toes of the feet should be more eleuated then the fingers of the hand, which kind of articulation we call *Enarthrosis* or *Inarticulation*.

The first.

The first of these that is set before the great toe, is the thickest of them all and the shortest, hauing a rounder head, that so the great toe might be better moued to the sides then any of the rest. In the lower part vnder the head, where it is articulated with the *Tarsus* or wrest it buncheth out into a proesse [fig. 2 ^o] whereinto is inserted the tendon of the seuenth muscle of the foote, and at the same place there are two Seede-bones greater then the rest, and crufted ouer with a gristle.

The second bone of the Afterwrest which sustaineth the foretoe is the longest, vnlesse it be the fift which sustaineth the little toe; for the length of this last is encreased by a notable proesse, [fig. 2, ^o] whereby it was articulated to the wrest, because it was to be lengthned into the outside of the foot to make a place of implantation for the tendon of the eight muscle of the foot. These bones of the Afterwrest aboue and below, haue *Appendices* crufted ouer with gristles; their substance also and their cavity which containeth their marrow is answerable to the substance and cavity of the bones of the Afterwrest of the Hand. Moreover they are thrilled with small holes, by which little veines and arteries, as in other bones, do passe in to nourish and cherish them.

The bones of the Toes.

After the bones of the Afterwrest do follow the bones of the toes which make the third part of the foot and are in number fourteen [fig. 1 A, fig. 2 A, B] for euery one of them consisteth of three bones, as it is in the fingers of the hand excepting the great toe; [fig. 1, 2, 5, 7, v.] and indeed their substance, structure and situation is little different from the hand, sauing that the first ioyns haue a deeper sinus because the deeper heads of the bones of the *Pedum* or Afterwrest are inserted into them. And although the heads of the bones of the foot are larger yet is not their sinus so large as in the hands, that so in extension the toes might be more lifted vp, and yeeld something to the ground vpon which we stand. The great toe is formed of two bones [fig. 1, ^o, x.] that the foreside of the cavity of the Afterwrest might more firmly rest vpon the earth. All these Bones aboue and below haue *Appendices*, and are crufted ouer with strong gristles to make the ioyn more glib which is articulated by *Ginglymos*, alwaies excepting the last bones of the toes, which are not articulated to any other bone, but haue nayles cleaving vnto them. Note also, that the knuckles of the toes are shorter then those of the hands, gibbous aboue and hollow below; the better to admit the Tendons of the muscles which bend the second and third ioyns. Againe, the first bones are greater then the second, and the second greater then the third, and the middle bone in foure toes seemeth to bee square. In like manner, the bones of the great toe are thicker then the bones of the thumbe: the rest of the bones of the toes are lesser then the bones of the fingers. Finally, the bones of the toes are also full of marrow.

CHAP. XXXVIII.

Of the Seed-bones and the Nayles.



THE Seed-bones [ta. 25. fig. 2, 4, 5] are of the same number and position with the Seed-bones in the hands, that is to say twelue, and they are so much lesse and lesse conspicuous in the toes then they are in the fingers; as the fingers are greater then the toes: notwithstanding as the great toe hath greater bones then the thumbe, so also are his seed bones larger. Wherefore at the first ioyn of the great toe neere the head of the bone of the Afterwrest which is articulated to that ioyn, there are two notable seed-bones which lye vnder the neruous part of the muscle which bendeth the first bone of the great toe: and

and of these the inner is bigger almost by halfe then the other, yea as big as halfe a great pease when the husk is off, and not much vnlike it. This bone the Arabians call *Albadara*, and they say (how foolishly let the Diuines speake) that of this bone as it were of seed a man receiueth the new body wherewith he riseth at the resurrection; that which lyeth vnder the second ioynt of the great toe and is much lesse then the former, leaneth vpon the tendon of the muscle which bendeth the second bone of the great toe.

Concerning the rest of the seedbones, they are disposed as is said in the history of the hand.

To this place we thought good to refer two smal bones found in the Ham neere the thigh-bone, and growing to the heads of the two first muscles which moue the Foote. These bones, saith *Vesalius*, are found in Harts, in Dogs, and Hares, and such like dry creatures, yea in old men also: Their surface is slippery and regardeth the vpper part of the lower heads of the thigh, to which bones this is peculiar, that they do not leane vpon the tendons of the muscles as other seedbones doe, but vpon their originals, like as doth the bony part which in old men is fastned to the Cube-bone, which bony part we meet withall in the tendon of the seventh muscle of the foote there reflected.

Furthermore, as we said before, that to the outside of the ioynt, whereat the bone of the Afterwrest which sustaineth the little finger is fastned to the wrest, there is a small bone annexed, so also in the foote at the ourside of the articulation of that bone of the Afterwrest of the foote which supporteth the little toe [14.25. f. 1, 2, 14] where the fist bone of the Afterwrest is articulated to the Cube-bone, there is also found a small bone at the insertion of the tendon of the eight muscle of the foot.

These seed-bones, although they seeme to haue the same vse that they haue in the hands: yet morrouer in the foot they are the cause why when we stand or walke, whether the place be rough or smooth, the foot applies it selfe more equally vnto the earth: as also to keepe the toes when we stand or walke, from being luxed by stones or any other eminent thing we should light vpon. Finally, the extremities or ends of the toes (as it is in the Fingers) are couered and defended with nayles fastned to the skin on the outside, of which we will adde a few words. The Nayles are called by the Grecians *ὀνυχες*, their roote *ρίζονυχας*, the bottome or white moone *ἀνταπλῆ*, and the filme that groweth to the roote *ἀρχιμῶν*. There are diuers opinions concerning the matter of the Nails: some thinke, it is a glutinous moysture parched and dried by the heate, and driuen vnto the extreame parts, and therefore saith *Hippocrates*, are the nails exceeding fast and thight, because their matter is baked together. Secondly *Empedocles* conceiueth, that the nails were made of nerues by congelation, and therefore *Pæsius* in his notes vpon *Hippocrates* calls the nails *Nervorum clausulas summas*, the terminations of the nerues giuen by Nature to make vp and establish the extremities of the body, and therefore if they faile or fall away it is a signe of great weakenesse. Thirdly *Aristotle* in the sixt chapter of his 2 booke *de generatione animal*, saith, that the nails, the haire, hornes, beakes of birds, hooues and such like are engendred of aduentitious aliment. Fourthly *Columbus* remembers, that some thinke the nails are amassed of a part of a bone of a nerue of skin (yea some say also) of flesh, but he doth not easily subscribe to their conceite.

Columbus saith, they take their originall partly from the skin, partly from the tendons of the muscles which extend the Fingers and the toes. *Bauhine* saith, that some conceiue them to arise from the crasse excrements of the third concoction, and therefore that they continually grow by an imperfect accretion, made by the Apposition onely or addition of Aliment, whence (say they) it is that they grow onely in length, not in bredth or depth, and therefore are to be excluded out of the number of liuing parts; notwithstanding *Galen* in his booke *de Admin. Anatom.* witnesseth, that there is conveyed to the roots of the nails, a veine, an artery and a nerue, by which they receiue aliment, life and sense, as other parts doe. And truly, two Nerues are not onely conveyed vnto the roots of the nails, but also doe creepe vnder the nails together with the veines vnto the very top of the Finger, yet we do not say that the nails haue sense, because these nerues are not distributed throughout the substance of the nails no more then are the veines which vnburthen themselves of the Aliment at the roots of the naile. We conclude therefore that the nails are encreased like the teeth by an Apposition of aliment to their roote, which was the best way, because they were euery day worn, and therefore had more neede to be restored in their length then in their bredth and thicknesse.

Their substance is of a middle Nature betwixt bones and gristles moderately hard, the better to beare the violence of outward iniuries, flexible or buxome that they should not breake

Albadara,
Arabians

Two seed
bones in the
hand.

They are

The Nails:
Diuers opin-
ions of their
generation

Their substance
is

but giue way to violence; pellucide or transparent and therefore they are either red or liuid according to their flesh vnder them: thin they are and conuex, that they might lye more snugly vpon the fingers, and this also maketh much for their security; for if they stood off from the flesh they would easily be torne from their roots. Againe, to make them more steadfast, they are fastned at their root with a Ligament, and because they must needs grow to the flesh and the skin, therefore the skin on the outside compasseth the root round, but the flesh groweth to them more inward. Vnder the nayles, as far as to the very extremities or ends of the fingers the tendons of muscles doe passe and are dilated vnder them, which thing, saith *Columbus*, I first obserued. And this is the reason why the part vnder them is of so exquisite sence, and the paine so great if any sharpe splinter or such like doe get vnder the naile.

Their vse.

The vse of the nayles is to defend the end of the fingers which are very soft, that they be not offended by outward occurrents; their hardnesse therefore giues a firmitude vnto the softnesse of the flesh. Againe, the hands had nayles for better apprehension, for we could not haue taken hold of many small things vnlesse there had bin fastned some hard body to strengthen and establish the fleshy extremities of the Fingers, which must be also sharpe or edged to enclose a fine and slender body, that otherwise would haue slipped from betwixt them. The Toes had nayles to couer and defend their extremities, and beside in station to beare the Toes against the ground with more resistance. As for scratching or clawing, or any such other vse of the nayles, we thinke it to be of the *by* and not of the *Maine*.

The conclusion.

Thus at length haue we, through the diuine assistance, brought vnto end a long and painefull labour, worthy indeed to haue beene vndertaken by a man of more sufficiency and of greater experience in this Art then I would haue my selfe esteemed to be; my Age & Meanes not affording me time or opportunities to doe that which I haue earnestly euer affected. But for recompence of these Defects (gentle Reader) I haue pressed the footsteps of the best and most approued Authors; wherein as my first and most simple intent was the bettering of my owne knowledge in so necessary a part of my profession, so being periwaded that thy profit might fall in with the same, I haue set before thee a Mirrour, wherein thou mayst see the true representation of thine owne Originall, Structure, Growth and Accomplishment: and learne thereby to giue the glory and profit of thy Creation, to him that according to his mighty working did first poure thee forth as a few drops of Milke, and after curdled and sam-

med thee vp into so exquisit a forme as thou art become the most wonderfull of all workes of wonder. To him therefore so admired and propitious a Creator, as-

cribe with me all honor and praise, and consecrate the glorious Temple of thy

body, and the Altar of thy Soule vnto the Deity, who created them first

of nothing, redeemed them when they were worse then nought,

and hath promised eternall mansions for them, to partake

with Himselfe, of euerlasting

Felicity. *H. C.*

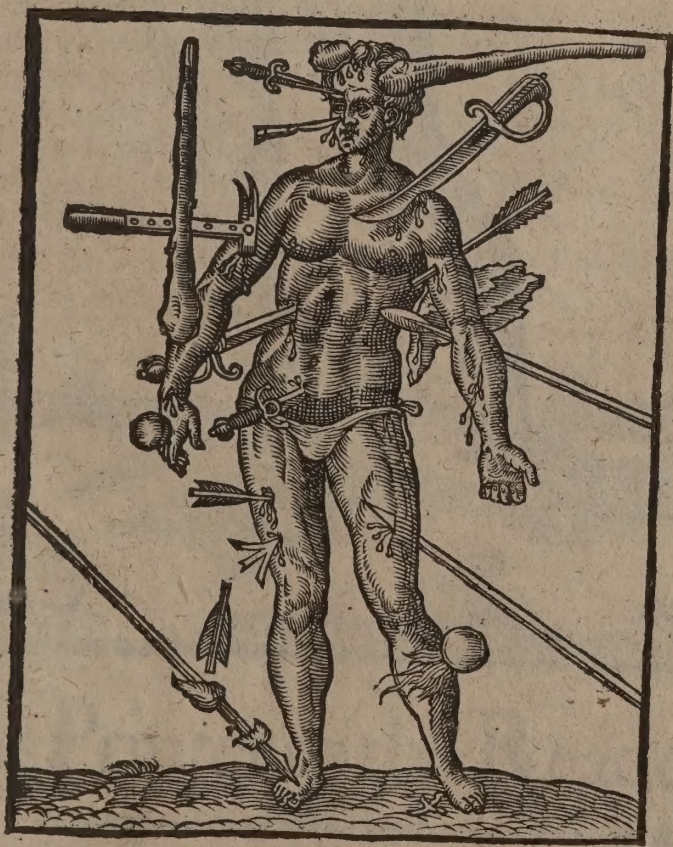
Παύστε δόξα Θεῷ.

FINIS.



AN
EXPLANATION
OF THE FASHION AND
vse of three and fifty Instruments of
CHIRVRGERY.

Gathered out of *Ambrosius Pareus*, the famous *French Chi-*
rurgian, and done into English, for the behoofe of yong Pra-
ctitioners in Chirurgery, by *H.C.*



London Printed for Michael Sparke. 1631.

AN
EXPLANATION
OF THE FASHION AND

Use of these and other Instruments of

War

As they are now used by the Indians of

Virginia and some of the neighbouring

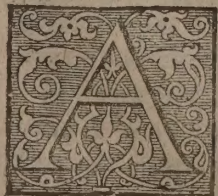


London Printed for M. B. 1721.

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The Printer to the Reader.



After Michaelmas Terme in the yeare 1629. A body was brought from the place of Execution to the Physitions Colledge to be Cut vp for an Anatomy, and by Chance, the officer of the Chollidge brought the body of a cruell Wretch, who had murdered the Son of one Master Scot a Chyrurgian of goodnote in this City. This Wrech was of a very truculent countenance and aspect, as the Almighty God would therein discover the cruelty of his heart. His haire was black & curled not very long, but thick & bushy, his forehead little above an inch high, his browes great and prominent, his eyes set deepe in their socketts, his nose crooked with a round knob or button at the end which also somewhat

and deformed body.

Additions
 necessary
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 Physicke
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 cessity for
 cannot be



The Preface.



He Art of Medicine which we commonly call Physicke, is con-
uersant about the health of the Body of Man; the most noble
Subiect of the whole Creation, if we except onely the Soule;
whose coniunction also with the Body, as it makes some of the
bodily operations more sublime, so it puts a greater honour
vpon that Art whereby such sublime operations are preserved
in their due tenor and integrity; or being vitiated are restored
to their pristine perfection. This Art (as all others) had her
Infancy, Childhood, Youth, and is at length growne to that
perfection of strength and accomplishment of parts, that the

Additions which are now made may seeme but a sagination to over-burthen it with vn-
necessary store; albeit we may not doubt but that some Moderne Diuine wits, may not
onely gather new consequences from the Dogmaticall Principles of the Ancients, and so
amplifie the Reuenues, but also purchase vnto our Art new Inheritance. In the Infancy of
Physicke, it fared with her as it doth with yong Children, whose indulgent Parents make
obseruation of and blesse themselves in any towardlinesse bewrayed by speech or gesture;
which may promise pregnancy in the time to come. The visible effects of the Art in hea-
ling of wounds, drawing arrowes out of the flesh, reposing luxed ioynts, setting broken
bones, and the like, were the first pledges of future proficiency, and the operations there-
fore were worthily had in great estimation. This part of Physicke was after called Chi-
rurgery, wherein, though learned men of all Ages haue taken great paines, as well in inuen-
ting instruments as remedies; yet the manuell administration they most what referred vn-
to seruants whom they trained vp for that onely purpose; Not that I suppose any worke
of Art to be dishonourable for the Artist to be employed in; but the sweetnesse of contem-
platiue knowledge, and the State and Estimation of Curing secret and abstruse diseases,
led those Sages from that which might be performed by others, to set themselves apart
and to spend their time in the disquisition of many subtilties which arose in the Physiologi-
call, Semeioticall, Pathologicall, Prognostique, and Therapeutick parts.

And hence only it is, that Chirurgery is famed for Antiquity: The euidence also of Sense
(because a Chirurgian may for the most part see his way before him, & feele how his Cure
commeth on) gaue it the priuiledge of Certainty aboue Physicke, wherein sometimes
Fortune, Nature alwayes hath an especiall claime. But neither that Antiquity, nor his Cer-
tainty doth free Chirurgery from the Alleageance she owes to Physicke; yea, they both
intend it rather: Antiquity, because it vshered Physicke into the World, but as a Hand-
maid of Honour; Certainty, as being a pledge onely and gage that Faith and affiance
might be put in that Art, in whose courser Administrations men might see and feele the
prooffe and effects.

My meaning is not hereby to Eleuate the worth of Chirurgery, but to put more honour
vpon it by assigning thereto a prime place in the Commencement, and a due respect
throughout the whole progresse of the Art of Physicke. In so much as those who are the
most expert Chirurgians, and would be so esteemed, doe strue at this day to furnish
themselves, not onely with the Physiologicall part (which they take to be of absolute ne-
cessity for their vse) but also with the Principles at least and Aphorismes of all the rest. It
cannot be denyed but that the manuell exercise is better learned by practise and experi-
ence,

ence then out of bookes: but as in Physicke there be many, so in Chyrurgery there be some speculations, which who so is incapable of (and all those are vncapable, who haue not at least some competent knowledge in the Theorie of Physicke) he shall neuer be worthy to be accounted a Master in Chirurgery. But to leaue that to be excolated by the posterity: For the present I haue been preuailed with, to this second edition of the Anatomy, to adde in fauour of yong Chirurgians, the deformation and explication of some such Instruments of this Art as may be of most vse. Wherein I will not tie my selfe to any method, because neither the peeces are perfect in their number, neither will the Volume to which the Anatomie is risen, admit of so large Addition. It shall be sufficient therefore briefly, and without any great circumstance to exhibite these formes and the vse of them out of *Pate-ns*, for I could not chuse a better Authour, that you may know the Printer will not spare for cost, to present you with the rest, if he finde these acceptable; especially if he can obtaine the body and substance of the Art of Chirurgery, to accompany these shadowes of a few Instruments and operations. Neither are you to expect curiosity in these very descriptions, but facility rather: for they are ordained for the vse of beginners. And euen for those rather, that they might vnderstand how other experienced Chirurgians goe about their worke, then that by this only manuuction, they should rashly aduenture vpon al these Administrations: but rather that they should be stirred vp to obserue the footsteps of others, who are better able to guide them; which they may do a great deale the better when they haue the Notion of these workes in their heads, before they haue their parts in the Aduenture. As also if they finde that Notion to be vnperfect, they may resort either to the counsell, or to the experience of such as can perfect it, and assoyle their doubts, which I foretell them will be many and important. Take this therefore in good part, such as it is, and that may haply perswade me to doe more for thee. Take my counsell also to exercise thy selfe rather in these and such like operations, then to bungle in the Practise of Physicke, wherein I am certaine thou hast lesse vnderstanding, if at all thou vnderstandest thy selfe.

The



The Practise of Chirurgery.

CHAP. I.

For the opening of Tumors.



When a Tumor is ripe, that is, when there is in it *Pus confectum*, at which time all symptoms of heate, paine, and the like, are mitigated, and the head of it is growne mucronated and soft, then it is time to open it, and not before. Neither ought the Chirurgian afterward to linger, for feare the humour shut vp in the flesh, should contract a venemous, or at least a malignant disposition, and by his contagion, infect the neighbouring parts. And this is especially to be feared, where the adjacent parts are of more exquisite sense, or of greater dignity: as also where they are more subiect to the confluence of excrements, or in a more prone position; for the waight of humours will naturally decline.

This apertion is made sometimes by a phlegme or lancet, sometimes by a penknife, as we call it, sometimes by Cauteries.

The phlegme or lancet, is that Instrument wherewith they vse to open a Veine, and may be of vse in tender and soft parts, and where the Apostemation is outward: The figure of it you haue here vnder set.

The forme of a Phlegme.



for with it the hand may be carried more steadily; you may strike deeper (if need be) and without danger that your Instrument should faile you. Heere you haue the figure ioyned to the handle, but turned out, to shew the crooked blade marked with [C] for that is most fit for almost all manner of incisions. Where there is any different forme to be vsed, you shall haue it expressed.

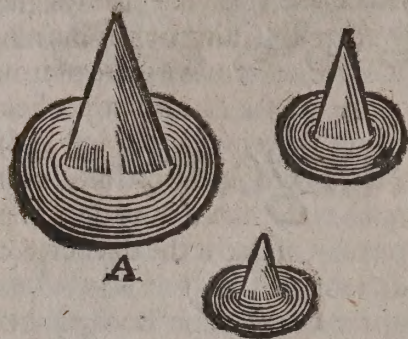
The forme of the Penknife standing out of his handle.



But because some faint-hearted Patients are afraid of this Instrument, Chirurgians haue devised to fasten the point of a Lancet or Knife in the midst of a piece of Coyne, to stand out as far as they would haue the wound to be deep. That coyne they couer with some thin Ceare-cloath, to hide the edge or point, pretending that Ceare-cloath to be the Medicine which shall make way for the matter to issue; but when they haue cunningly conueyed the Coyne vpon the Apostemation, suddenly they presse it as hard as they meane to make the Incision deeper; and

and therefore they are not without diuers of them, some larger, some smaller, some with deeper or longer points, some with shorter and shallower, according to the worke they are about. Heere you haue three figures of them: the letter A shewes the round plate, or coyne wherein the point of the Knife or Lancet is infixed.

Plates or Coyne of Siluer or other Mettall wherein the point of a Lancet is fastned.



Other clealy deuices also there be to open Apostemations; as rings wherein the point of a Lancet or Knife is concluded and fastned, at pleasure to be let out, when the Chirurgians finger is neere the Apostemations. As also hollow pipes made of Cane, Plate, or Wood, as big as a little finger, wherein are contained other smaller pipes as bigge as a Swans quill, in the end whereof is fastned the point of a Lancet, at such length as the Chirurgian thinks fit for his operation. At the end of the greater cane next his hand standeth a Vice or Spring ready bent, which Spring when the Chirurgian looseth, the smaller or wider

cane whereto the point of the phlegme is fastned, suddenly is darted out of the larger cane and striketh the Apostemation as deepe as is desired, much like these bable quills which children buy at Bartholomew Faire, out of which they can shoot a Snake to scare their fellows: and indeed these deuices are but bables, the phlegme or Penknife are more certaine Instruments, notwithstanding, because some nice people are taken with such quaint deuices, you haue them hereunder delineated and explained.

Other Instruments to open Apostemations.

Rings wherein the points of Lancets are hidden.

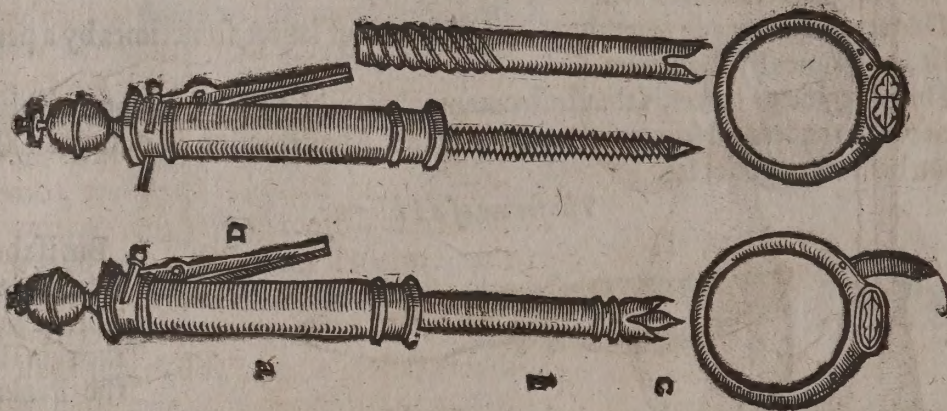
Certaine small Canes or Trunks wherein Lancets are fastned, called Manuela or Anterior.

a, Sheweth the greater Cane or Pype.

b, The smaller Cane or Pype contained within the greater, to the top of which the Lancet is fastned or ioyned.

c, The Lancets point appearing.

d, The Spring or Vice which shooteth out the Lancet called Manuela.

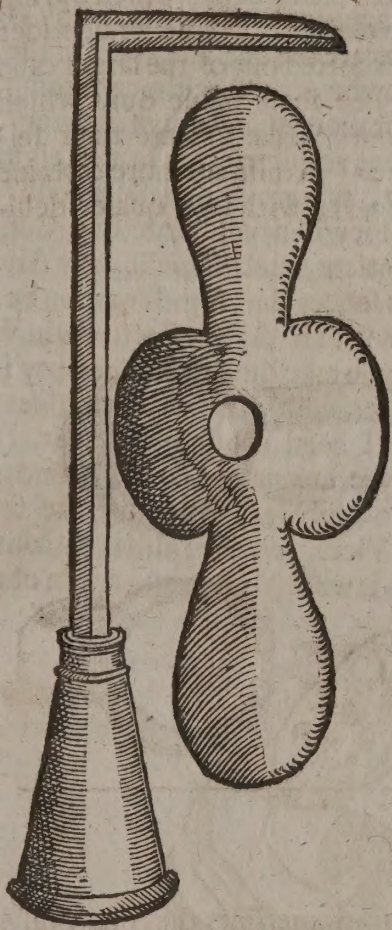


CHAP. II. Of Cauteries.

Sometimes the Patients nicity, sometimes the place, sometimes the condition of the Tumor, require that Knife and Lancet be forborne, and then Apostemations may be opened with Cauteries. They are either actuall, or potentiall. The actuall Cautery is an hot iron. And this alwayes fittest where the matter concluded is poysonous, whether it be in an Apostemation, or vpon the biting or stinging of poysonous creatures, for fire is a prompt worker, vehement also and sudden, and the Eschar will sooner loosen and fall: Beside, the vehemency of actuall fire makes a greater impression vpon the adiacent parts, and keepes the issue longer open, which is the reason that in pestilent constitutions, we vse to make issues to choose with actuall Cauteries; and because the time requires it, I will tell you where it is fittest to make them, to wit, in the right arme, a little vnder the second muscle, called *Deltois*. and againe, on the outside of the left leg, betwixt two and three inches vnder the knee. But you must remember that I giue you this counsell of vsing Cauteries in cases of poyson, then onely when the poyson is in or neere the surface, and not when it hath insinuated it selfe deepe into the body. For if the actuall Cautery reach the poyson, it will extinguish it, if it cannot reach it, it will exasperate it more; beside, the payne and terrour it carries with it, weakens and affrights the Patient.

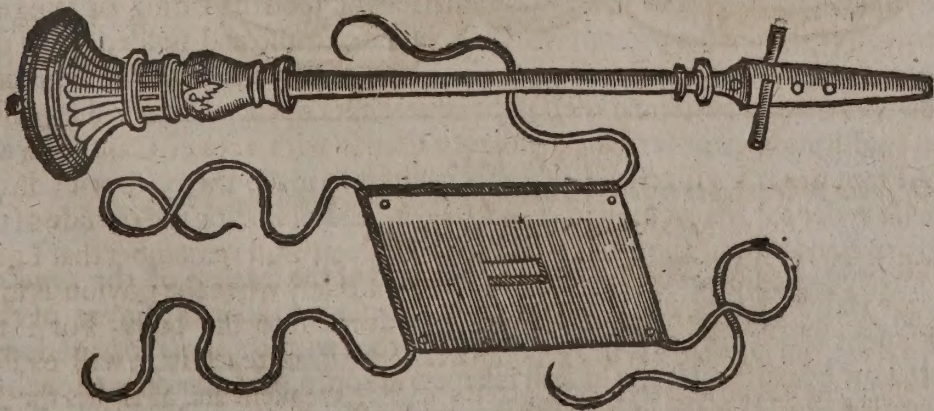
trient much, and breakes his spirits. Notwithstanding, there is frequent vse of these actual Cauteries in the *French* disease, and they are made differing, according to the severall parts whereto they are to be applyed; all which for me to prosecute, were against my present purpose. You shall finde a little hundred of them delineated in *Ambrose Parries* xviii booke, which he wrote *De Lue Venerea*. I will content my selfe to particularise in one or two and these also described by *Pareus*. In his seventh booke and the fift chapter, is an Instrument to be vsed in the cauterizing that tumor which is called *Ranula*: (it is vnder the tongue, and corrupts the speech) This Tumor if it be any other way abated, (savouring by the burning iron) it will grow againe, and he maketh such a device for it. First, he frames a plate of iron, such as you see hollowed on the inside, and with a hole in the midst. The mouth is held wide open, and the plate applyed to the Tumor, so that the hole therein may fall iust vpon that part of the Tumor, which you would open: then with a red hot crooked iron like this in the figure, pierce the Tumor, and therewithall, with your thumb vnder the root of the Chin, beare vp the Tumour with some force and strength, that you may pierce it the deeper, &c.

The forme of the Iron plate and of the actual Caution.



In the tenth Chapter of the same Booke, hee describes the manner of the vse of the Caution in *Empyemate*, that is, when vpon a squinzie or pleurisie, or other wayes sometimes, there is a notable collection of purulent matter in the capacity of the Chest. This is a worke not to be aduentured vpon by one man, but hee had need of the best helpe hee can get; neither will the skilfullest Chirurgian vndertake it, without the aduice and presence of the learned Physitian. But it is to be performed on this manner. The Chirurgian must begin to number the ribbes, from beneath upward, till he come to the third true rib, betwixt that and the fourth must the worke bee done. Where the Chirurgian shall place (vpon the side the Physitian shall designe) an iron plate with a hole in the midst, fit for the Caution to enter into. That plate having strings at the foure corners, must bee tyed on the other side of the Patients body, so fast that it may not moue, and it must also be bowed somewhat compasse, that it may comply with the fashion of the ribbes. In the Cauterizing iron, there must be diuers holes, wherethrough you shall put a bolt of iron, at that distance from the point which you will allow to make the perforation: so if the plate bee fit, the hole of it even with the distance betweene the third and fourth rib, the Caution red hot, and the bolt in it that it pierce not too deepe: Finally the Chirurgians hand steady, and the assistants enow to hold the Patient, the worke is soone and safely performed.

And this operation is called *Paracentesis*: some of *Pareus* his counsell which followes I doe not so well like.



A type of the actual Caution, & his plate to be vsed in the opening of the side.

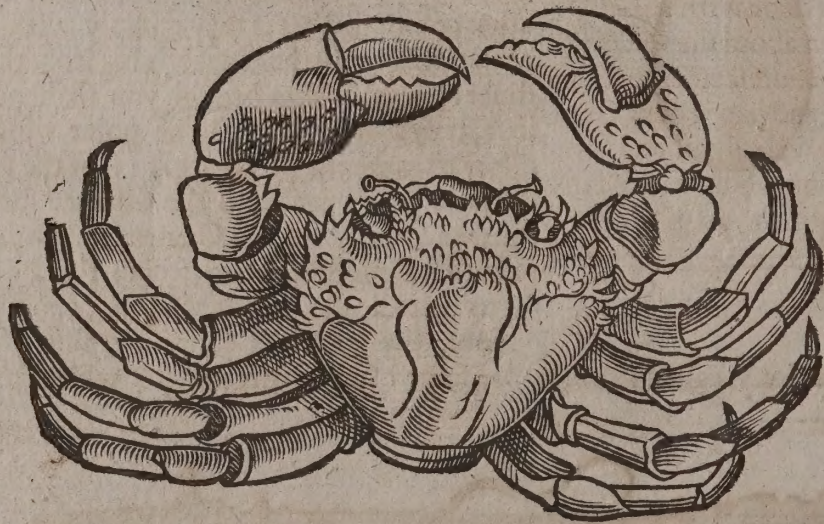
There is an other like operation in *The Efflu- la,* the Fistu-
lures.

la of the eye; but I leaue or referue that as more curious for skilfull Artists to thinke better vpon. Neither am I ignorant of many other actuall Cauteries made of melted lead, scalding water, roots of Gentian and the like burnt red hot; nor of that *Vstio Arabica*, mentioned by *Plinie*, approued and described by *Dioscorides*, and commended by some of the late Writers for the Hip-gout. But it were beside my purpose to insist vpon that or any other particulars. Euen potentiall Cauteries I pretermit, because I limit my selfe for the present, to describe a few Instruments onely.

Notwithstanding before I part from this place, I will take so much liberty, as to aduise the Nouice Chirurgian what he ought to represent to himselfe before he open any Aposteme, either with the knife, or with the Cautery.

1 The first thing is, that somt Apostemations are mortall, and some so dangerous that
2 they must not be medled with at all, or not without great circumspection and assistance: as
3 all Apostemes of inward and noble parts, though they appeare outward, as those in the Li-
4 uer, spleene, &c. Againe, beware of opening an Aposteme in an acute and originall Fe-
5 uer. Thirdly, take heed you mistake not Ruptures for Apostemations, either in the flanke
6 or in the cod. Fourthly, take heed of Apostemes which happen in the heads or tendons of
7 Muscles. Fifthly, beware of an Aposteme, if the basis of it appeare broad without any vi-
8 sible acuminated. Sixtly, you must open an Aposteme as neere the declining part of the
9 tumor as you can, that the matter may issue out of it of it owne accord without forcing.
Seuenthly, in incisions beware of a great branch of a veine, or more especially of an artery,
which you may many times meet withall, in the necke, armes and legges. In the eight
place, if you meet with a tumor in the legs of a dropsie body, where the dropsie is confir-
med, and the Liuer ouerthrowne, take heed of opening it, for it will neuer heale but Gan-
grenate: and you shall bring misery and death vpon your Patient, and discredit your Art.
The like may be said of an old and effoete body, in what part soeuer the Apostemation be.

Finally, (for it were tedious to pursue all) if you meet with an Apostemation which
will yeeld abundance of matter, take not all out at once, lest you take life & all, but empty it
by fits and degrees. Some of these Cautions you must also remember in making of issues;
but for the manner of doing that worke, it is so obuius that I need not insist vpon it. I
haue forgotten my selfe too much already. Onely because the *Cancer* aboue all Tumors
hath most need of the actuall Cautery, if a man may come to apply it; and because the fa-
shion of a Crab doth represent the horrid forme of that Vicer, whence also it hath his
name; you haue here a Crab figured to make vnto you (as it were) a representation of a
Cancer.



CHAP. III.

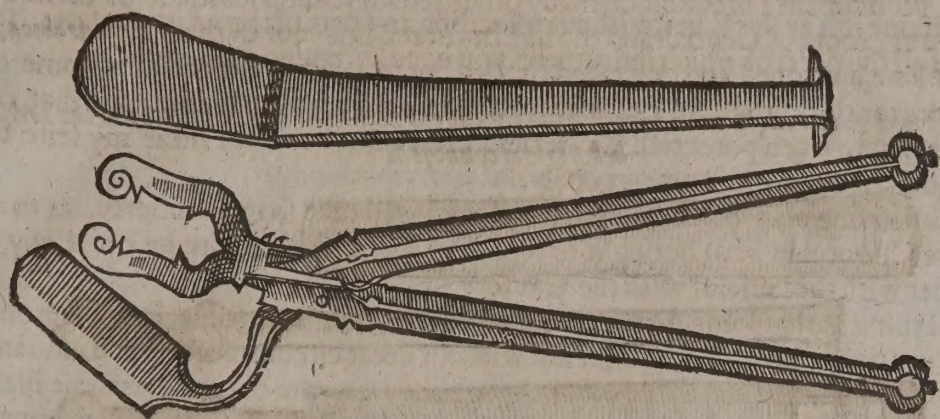
Of some Instruments to be used in the swelling and exulceration
of the Columella or Vuula.



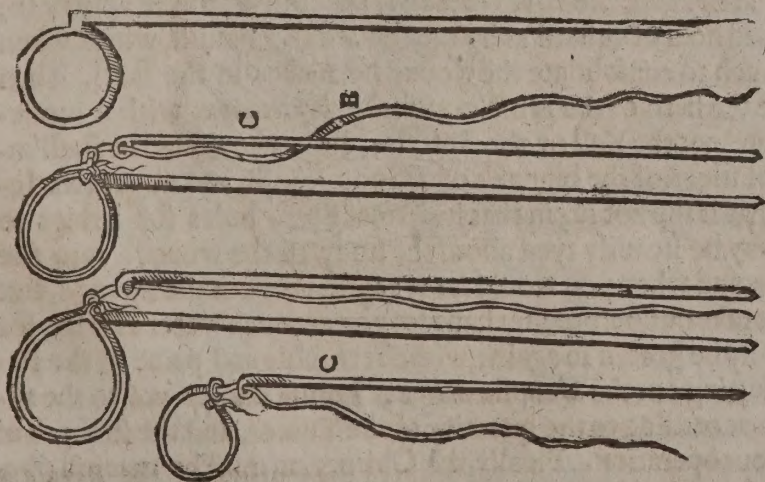
Ecause in the former Chapter I made mention of the searing of the *Ranula*, a
Tumor vnder the tongue, I thought fit in this place to adde the figure of that
Instrument which they call *Speculum oris*, together with a *Spatula* to hold downe
the tongue, because by it the mouth is kept wide open, and the tongue couched,
when the Chirurgian would worke in it by section, constriction, or any other operation.

Speculum

Speculum Oris.



Now in the mouth next, the *Isthmus* of the throat hangs a fleshy particle, called *Columella*, we call it commonly the *Vuula*; but indeed it is then onely truly *Vuula*, when it is swelled and hangs low vpon the throat; sometimes it will be extreemely inflamed, and looke like a ripe and blue Grape of a *Cancerous* colour round and fiery. Mitigate it then you may by opening the veines vnder the tongue, &c. But *Pareus* sayes you must not vex it any way: but if it be rather swelled then inflamed, and that by a distillation from the head, then (if other ordinary courses will not abate it, but that it lies continually vpon the throat, as if it would choake a man) he may flie to the helpe of Chirurgery. And for this purpose *Honoratus Castellanus*, Physitian in Ordinary to the *French King*, deuised a fit instrument to twitch some part of it, which part will in short time fall off, and no fluxe of blood will follow it. First, he frames an iron rod, the length of a mans finger, and to the top of the rod fastens a ring about the bignesse of the end of the ring finger, the vpper circumference whereof is a little hollowed, that a thred of silke may ride in it: Then he prouides another rod, with a hole drilled in the top of it, through which the taile of the thred falleth after the riding knot, or noose is put vpon the circumference of the ring. These rods, with the noose of the thred vpon the ring, and the end issuing through the hole of the second rod, he puts into the mouth, till the ring be put vpon the *Columella* so farre as he listeth; then he drawes the noose of the thred, which easily separateth it selfe from the ring, and twitches so much of the *Columella* as it comprehends. The thred had need be strong and waxed, or I thinke it may be better done with a small line of horse haires, whose noose haply will stand open or till it be gotten about the *Vuula* without an instrument, but more easily about a *Polypus*, any Warts or excrescences in other parts: but you must remember that euery day the noose (whose end hangs out of the mouth) must be gently strained, by putting it through the hole of the second rod, and thrusting the rod vp to the noose which is about the *Columella*, till the vnprofitable part fall away. You haue three figures of this Instrument, that you may vse which you please.



The type of Constrictory Rings with threads fastned to them to twitch off a part of the *Columella*, *Polypus* or the like, if there be need.

A, the rod with the ring, whose vpper circumference is somewhat hollowed.

B, The thred or line which compasses the ring with a noose or running knot.

C, The second rod through which the thred passeth by a hole in the top of it whereby the noose is to be gently strayned.

But if beside this swelling or relaxation of the *Columella* (of which we haue already spoken) there is also an eating *Vlcer* adioyned (as sometimes it happens) and a flux of blood with it; then it will be necessary to seare the *Vlcer* with a Style blunt at the end, and red hot

hot running in a hollow pype, somewhat thicke, neere the end whereof, a little window or gutter, as it were, is cut out, so that the hot end of the Style, through that window or gutter, may arrive iust at the Vicer, without offending any part of the mouth beside. The formation of all the parts of which instrument, you haue herunder annexed.

The pipe guttered, or with a small window cut out neere the end, unto which the red-hot Style is conueyed.



CHAP. IIII.

Of the Paracentesis in the Dropsie.

Here is a great question among Physitians, whether it be according to Art, to administer the *Paracentesis* in a Dropsie. I will not stand to dispute the question, onely one obiection there is which must be satisfied. If the Liuer be not vitiated, say some, then the Dropsie may be cured by other meanes. If it be vitiated, then this operation is in vaine, because the cure is desperate, and in a desperate cure to torment and trauell the Patient so much, and beside to discredit a mans Art, is a trick of him that seeks worke for his owne ends. I answer, that there is a great Latitude in the indisposition of the Liuer in a Dropsie. If the Liuer be in fault alone, or originally, as alwayes it is not: For sometimes the Liuer is ouer-cooled indeed, and the serous matter thereupon gathered in the capacity of the *Abdomen* in great quantity, yet such a Liuer may be restored; especially if it be not perboyled too long in that Lye. Sometimes it is *schirrhous*, and circumscribed, and yet is recovered, if the water be in due time taken away. But if the worke be deferred till the whole frame and tenor of the Liuer be ouerthrowne, then indeed it is in vaine to open the *Abdomen*, because a principall part is vtterly forfeited. But if there bee any hope that the Liuer may be restored (which none but the diligent Physitian is able to discern) then the *Paracentesis* is fit to be vndertaken after this manner. If the Dropsie proceed originally from the Liuer, the section must be made in the left side, the bredth of three fingers lower then the Nauell, as neare the edge of the right muscle as you can imagine; so you shall auoyde the white line and the tendons of the rest of the muscles of the *Abdomen*. Place therefore your Patient vpon his right side, then let the Chirurgicalian pinch vp the skin with two fingers in the place before mentioned, together with the fleshy pannicle vnder it, and so pinched and held vp, hee shall diuide it ouerthwart to the very flesh, and then draw vp the skin he had hold of as hard as he can toward the Nauell, which when it falls againe, will assist him much to consolidate the wound he makes in the flesh. Then let him with great care diuide the flesh of the muscles and the *Peritoneum* with a moderate wound, and so that he offend not the Kell or the Entrals; Into that wound he shall insinuate a crooked pipe made of silver, of the bignesse of a Goose-quill, and about two Inches long, with a broad head that it slip not in; in that head make two holes for strings to runne in, whereby the Quill may be steadily tyed about the body to the wound. Into the head of the quill put a Sponge, and when you would let it runne, take out the Sponge, but the quill or pipe you must not take out, before you haue let goe as much water as is fit, for if it be once out, it will not easily be gotten in againe, without trouble and paine to the Patient. For the proportion in letting out the Dropsie water, I must referre you to the aduice of a learned Physian, who, according to the quantity of the Tumor, and the strength of the Patient, must moderate your operation. Finally, the Chirurgicalian must be carefull (beside the ties of the quill to hold that steady) to provide also fit ligatures, and strong with pledgets, &c. to contract and make firme the orifice of the wound whereinto the quill is insinuated, lest the humour get a vent by the wound and spoyle all. The figure of the quill with his head and ties, you haue hereunder expressed.

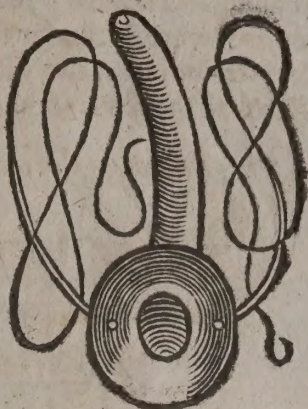
The

The fashion of the Quill or Pype to draw out Dropsie-water.

CHAP. V.
Of Ruptures.

T Here be many sorts of Ruptures, or Relaxations, whose names are taken from that which falleth downe: for it is the *Peritoneum* or Rimme of the belly onely which is broken or relaxed in them all. Sometimes the gut, sometimes the kelly, sometimes both fall together; and the Relaxation is at the productions of the *Peritoneum*. Vnlesse it be that we call *Exomphalos*, when the *Peritoneum*, at the Navel is relaxed or broken, and the guts or kelly, or wind, or flesh, or humor, make a Tumor in that place; which I haue seene as big as a mans head. I will not particularise heere of all the kindes, onely let me tell you, that in children a cure may be made according to the first intention as we say, but after childhood not so, or at least very rarely, and by accident, as it happened to the Priest *Pareus* makes mention of; then the Trusse is most in vse. Sometimes also the golden ligature.

For the Trusse, it is made diuers wayes by diuers men, some of Holland, some of Fustian, of Taffata, &c. Some stuffed with Bumbast, some are made of Steele which in my opinion are the best and the easiest, if they be made light and fit. All the skill is in fitting them to the Patients body, but first the Tumor must be genly returned vp. I know there is a trick lately brought out of *France* to trusse a man vp with I know how many Ells of Holland, and I beleue there may be some skill in the manner of the tying of the *Fascia*, but I haue experience that it hath done more harme in heating the backe and sides then good, by the fastnesse of the Ligature. Neither doe I thinke it possible to make any Ligature of that kinde so firme as the ordinary Trusses are, especially if we would vse the backe and shoulder band to our Trusses, which I see few doe. Wherefore my Counsell is, that men thus affected, resort to such Chirurgians as make their trusses themselues, and can fit them precisely. I haue exhibited two figures of them hereunder.



The figure of a man broken on one side, together with his Trusse, whose bolster hath three swelling inequalities, two in the vpper part, and one in the neather, and betwixt them somewhat hollowed, that it may not ly too hard vpon the shere bone. This will serue when the gut or the kelly falls into the groyne.

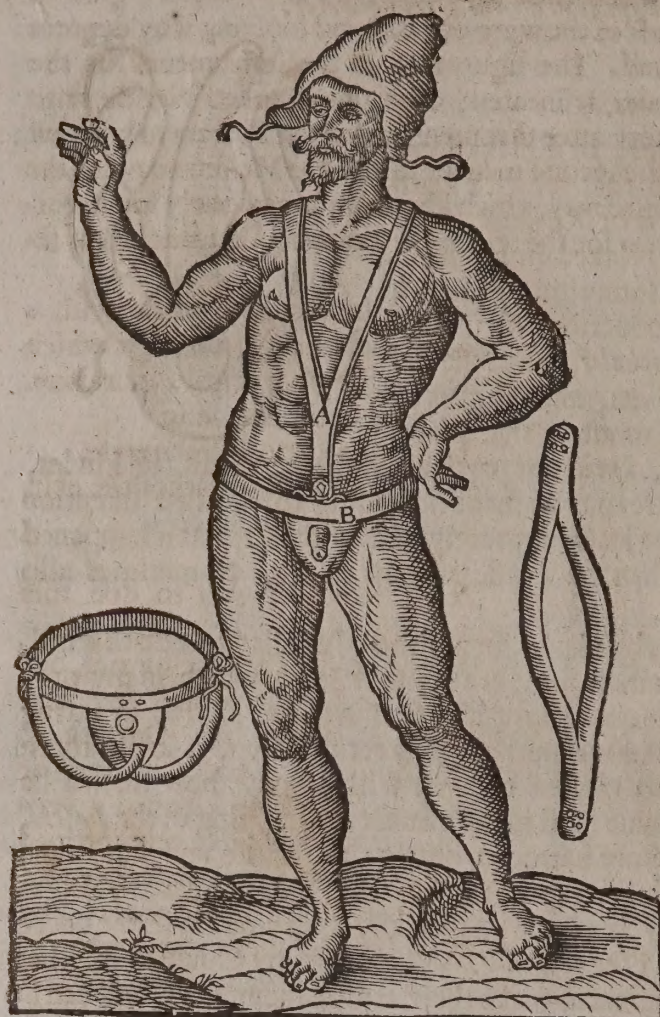
A, A *Fascia* or band that goes ouer the shoulder, and is fastned behind and before to the girdle of the Trusse to keepe it in due place.

B, The girdle or Trusse.

C, The cavity of the Boulster in the midst of the swelling inequalities where it is better stuffed.

But if a man be bursten on both sides of the Groyne, which is a thing not very vnusuall, then the Girdle is made like the former, but there must bee two Boulsters, or at least a Boulster fitted for both sides, hauing a hole through it, whereat the Yard may issue; the fashion of it is such.

A figure



A figure of a man burst on both sides; together with the fashion of a Trusse, with a double Boulster; and a hole in the midst for the Yard: the inside of the Boulsters must be like that before described.

When the excrements fill the gut which falleth downe into the Cod, and so the gut cannot bee issued backe by the rupture by which it fell, *Pareus* hath devised a refuge in that last extremity: An Instrument to cut the Cod, and so the *Peritoneum* larger then the rupture, that so the gut with the excrement may be returned vp againe. But this may be a helpe in a deplorate case, and needes a hand more curious then stands in need of my helpe to direct, and therefore I passe it by. The perforating of the *scrotum* in a water Tumor about the Cod, or in the Navell, are easie operations, I will not stand vpon them.

There is also another trick to cure a rupture, by giuing the fine powder of a Load-stone in Water-gruell, or the like inwardly, and strewing the filings of iron vpon the place tumified; but looke for this in *Pareus Lib. 7. Cap. 15.* But he tooke the manner of the Cure vpon trust.

CHAP. VI.

Of the Golden Ligature, or Golden Punch as they call it.

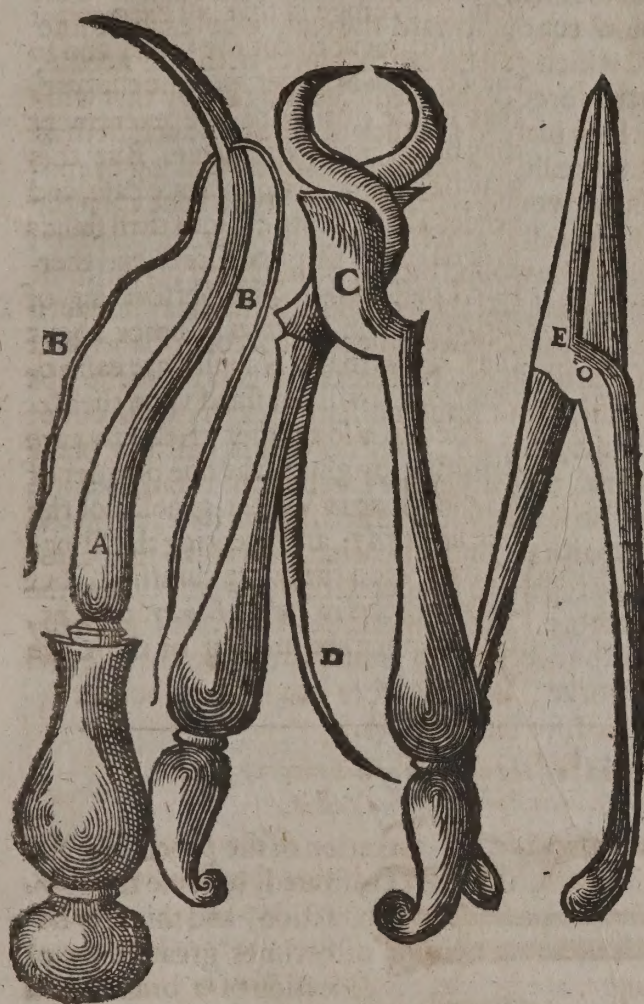


Here is another way of curing the Rupture, or Relaxation of the proceffe of the *Peritoneum* by incision, in which a man is alwayes castrated, because the *Spermaticke* vessell issues through the said proceffe or production, and this way beside the castration, is also very dangerous, because oftentimes great fluxes of blood follow, and sometimes the parts Gangrenate, beside, the dissection of a branch of a nerue of the sixt coniugation which is transmitted to the Testicles; ad hereto inflammations, conuulsions, and other like fearefull symptomes which follow this castration, and commonly death also. All which to preuent, the Chirurgians haue inuented a quaint way which they call the golden Punch or Ligature, because it is done with threds or wyre of gold. But *Pareus* likes better to doe it with Lead, and to other manners of Administrations prefers this which I shall now describe vnto you, because the Lead he vses, he afterward takes away, whereas the golden wyre must be left within when the wound is healed.

Lay the Patient with his thighes somewhat high, and his head somewhat low. Then diuide the skin a little about the share-bone, where the Tumor is, as farre as the proceffe of the *Peritoneum*, which with a Probe about the bignesse of a Goose quill, insinuated into the wound, and strained vpward, they carefully seuer from the fibrous and neruous particles which cleaue vnto it, as also from the *Spermaticall* vessell, and the *Cremaster* muscle of the testicle. When they haue thus separated the proceffe, they conuey vnder it a small wyre of Lead, and whip it once about the proceffe as farre as they conceiue it is too much relaxed, but leauing the *Spermaticall* vessels free. The ends of the wyre with a paire of small Pincers, or Mullets made for the purpose, they straine together and twine; neither too loosely, lest they leaue a way for the kell or gut to fall downe againe; nor too hard, lest they intercept the passage of the spirits, and of nourishment from the parts thereunder, and so they Gangrenate. The very ends of the wyre they suffer to hang out at the wound.

When

When that contraction of the *Peritoneum* is in time (put case in 12 or 15 dayes) growne callous, then they gently untwine the heads of the wyre of Lead, and loosning it by degrees draw it away, and then heale vp the wound. The figures of all the Instruments for the performance of this operation, be hereunder delineated; euen the crooked Needle with the thred in it, if the Chirurgian would work after that manner, and the Pincers to crop off the golden wyre, if he would doe it after the second manner; as also the Mullet to twine the Lead, if he will performe his worke the third way, which I haue described onely for breui-ty sake, and referre the Chirurgian to *Pareus* for the rest, in the sixteenth Chapter of his se-uenth Booke.



A, Shewes the crooked needle with a hole neere the end, through which the thred or wyre of gold is drawne.

B, The wyre or thred it selfe.

C, The Pincers to crop off the wyre.

E, the Mullet which wreathes the ends of the wyre in compasse.

There is another way to doe this worke with a Causticke, pretended to be safer and easier then the former, but I doe not conceiue it to bee so, and therefore I passe it by. One thing onely I thinke fit to adde, by way of caution, because I my selfe had a very late experience of the like case. A child had a rupture, (as was thought) and for that infirmity had a Trusse made, and wore it a yeere or more; at length vpon further disquisition, I found that there was but one Testicle in the Cod. The other was not descended, but lay in the flanke, and was mistaken for a Rupture; the Trusse being remoued, and the childe now grown to be about seuen yeeres old, the Testicles descended into the *scrotum*, and the Tumor in the flanke vanished. Such an experiment *Pareus* hath, and truely it was his experiment that led me to finde this error committed in this childe.

To particularize concerning the seuerall sorts of Ruptures and their Cures, were to entertaine you too long in an vnfit place; yet I will not forget to remember with honour that Haudy Chirurgian Master *Gillam*, who in a Patient of mine, cured a great *Hydrocele* or watery Tumor in the Cod, neuer vsing any Seton, haire, needle, or silke; but with his Lancer diuided the *scrotum*, and the pellicle wherein the water was contained, and let it out, and healed it vp againe, after which it neuer grew.

CHAP. VII.

Of five kindes of Sutures.

THe next thing I will intreat of, shall bee the manner of making sutures, or seames; wherby Chirurgians vse to sew vp wounds, when they find it necessary, & that is whe the sides of the wound cannot be fitly ioined together by a ligature or swath-band, as in most transuerse wounds it hapneth, because the flesh & other similar parts being dissected ouerthwart, flye & are contracted toward the whole parts, and so make a greater separation, whereas if the wound be lengthwise, the separation of the part is not so great, but that a fit Ligature may vnite them againe. In which operation it is generally to be obserued: First, that there be no *heterogeny* left in the wound, no peece of the weapon, or the like.

like. Next, that the suture be immediately made after the wound is giuen, or as soone as may be; and againe, that the deeper the wound is into the flesh, the more flesh be also taken vp with the needle, otherwise if the surface onely be sewed, the flesh vnderneath the suture which is wounded, will turne into quittance, and apostemate into a caue or hollow Vicer.

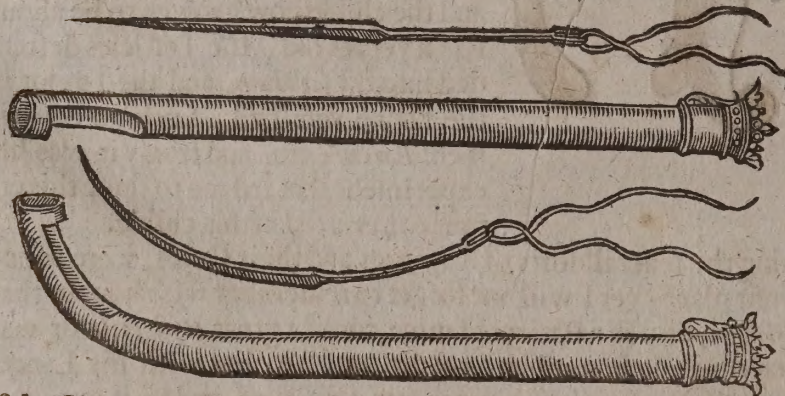
There are five kinds of sutures.

The first vsed in fleshy parts, not fit to be swathed, is after this manner.

The needle must be long and slender, and toward the point three-square, like a Glouers needle, for so it will pierce better; the eye somewhat hollowed that the thred may bee hidden, as it were, in the gutter of it, and so it will more easily follow the needle. You must also prepare a siluer quill, with a window cut out toward the end, whose whole side you shall place against the lip of the wound which you meane to pierce with the needle, as well to keepe it steady and firme against the force of the needle, as also that by that window, you may perceiue when the needle hath pierced so much of the skinne and flesh as you desire, and through it may also draw the needle and his thred without shaking or moving the sides or lips of the wound. When the wound is stitched vp, tye a knot vpon the thred, as neere the skin as you can, and cut off the rest that it sticke not to your Emplaisters.

But in the stitching you must obserue, that if the wound be any thing large, you must take the first stitch about the middest of the wound, and the second in the midway between the first stitch and the end of the wound, and the third answerable to the second, for betwixt euery stitch there should be aboue halfe an inch distance. Neither must you draw the lips of the wound close together with your stitches, but leaue a distance betwixt, that out of that distance the quittance may vent it selfe as it groweth, for otherwise it will not onely cause paine and inflammation, but so tumifie, that either the stitch or the thred, or both, will breake. Obserue also that in taking vp the skinne with the needle, you take not vp too much flesh with it, for that will increase the paine and inflammation, and make the Cicatrice or scarre more deformed. But haue due regard to the depth of the wound, and the shallower it is take vp lesse flesh, the deeper more. Yea, sometimes the wound in fleshy and brawny parts will be so deepe, that it will be necessary to provide a crooked needle, and a crooked quill or Canule, to performe the worke, and therefore you haue hereunder described of both sorts as well straight as crooked, for seuerall vses.

A type of the Quills and Needles required for the making of a Seame or Suture.



Obserue by the way that the silke thred waxed, is to be preferred before the thred of Line: and *Blondus* giues a good reason for it, for it will not so soone rot as the other.

The second kinde of Seame or Suture, is like that of Glouers, or that

of the Skinners in sewing their Skinnes together. And it is vsed when the entrals are wounded, lest the excrement should issue out. I doe not beny but that it is possible such a cure may be wrought, but how hard it is to come to them, to doe the worke, and how dangerous after it is done no man doubteth; yet any thing almost may be attempted to saue life, if it may be, and Nature sometimes doth incourage vs to that which Art would thinke and leaue as desperate.

The third kinde of Seame, is that which Chirurgians vse in the Cure of the Flax-lip, that is, when the vpper lip in the middest, is separated the one halfe from the other, and that from the birth, as it hapneth many times. They vse the same Suture also when the lip is so wounded by accident, as also in maine deepe wounds of the flesh, whose lips are farre distant. The needles (for they must be diuers, sometimes many) must be triangular or foure-square, almost throughout the length, and the thred well waxed that it breake not. That needle (if one stitch wil serue) must be thrust through both sides of the wound or breach, and take vp all the flesh of both lips, and there sticke halfe the needle at one lip of the wound, or breach

breach, and halfe at the other; and in the same manner, another short needle (as the place will beare) must be thrust in the middest, crosse the former, and vnder the flesh as the former is. Then the thred which was in the eye of the first and longest needle, must be strayed crosse about all the foure ends of the two needles, seuen or eight times, or more, to hold the lips of the wound or breach firmly together till the vnion be perfected, and then the needles must be taken away, and the wounds they make healed according to Art. But if it be a Hare-lip that was a fault of Conformation, the skin on both sides of the diuision must first be cut away, otherwise the sides will not vnite. The figure of this kinde of Seame you haue hereunder expressed.

The forme of the Suture for the Clouen or Hare-lip, together with the needle and thred rowled about them.



The fourth kind of Suture is called by a proper name *Gastrographia*: and is proper to the lower Belly, when the muscles of the *Abdomen*, and the *Peritoneum*, are mainly wounded; in so much that some of the entrals sometimes fall out, but the *Omentum* alwayes, at least a part of it. If the wound passe no further then to the *Peritoneum*, it may be cured after the ordinary way of curing simple wounds: but if the *Peritoneum* be wounded, then the worke must be performed after this manner. First with your needle take vp the *Peritoneum* alone, for example, on the right side of the wound, (for you may begin on which you please) and passing by the left side of the *Peritoneum* take vp the flesh of the muscle, & the skin with it on the left side. Then take vp the left side of the *Peritoneum*, and passing by his right side, take vp the right side of the muscle and skinne. Then take vp the right side of the *Peritoneum*, and passing by his left side, take vp the left

side of the flesh and the skinne, and so sew your Seame crosse in and out, till the whole wound be seamed. The reason of this manner of seame is, because the *Peritoneum*, being a membranous part, and without blood, cannot re-vnite, vlesse it haue a bloody part ioyned to it, which in this manner of suture it hath quite through the length of the wound. You must also obserue, that this seame must be sewed as close as well may be throughout the length, till you come to the decliue or lower part of the wound, there you must leaue a stitch at least, both in the membrane and in the muscle, at which vent the *sanies* and matter may issue, till there be none left, and then it must be healed vp with a *Cicatrice*. Obserue also, that if any of the *omentum* issue out of the wound, it must not be reposed, but cut off; for that fat is feculent, and if it once take the aire, or rather the aire take it, it will putrefie. Also if any of the entrals issue at the wound, the Patient must be laid in such a position as they may best be reposed, and that must be done with great tenderneffe and easinesse of hand, that the ayre come as little to them as may be, and that they be not violated or shuffled in the reposition.

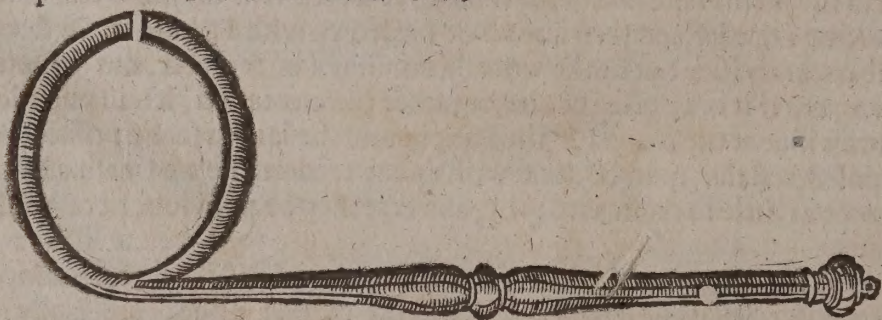
The fift kinde is called the dry Seame, which is vsed onely in wounds of the face, to auoyd scarres which will make the face deformed. For that is the market place, especially in women, to please whom Chirurgians haue deuised this kinde of Suture.

According to the bignesse of the wound, you must cut out a paire of Indentures, of strong Cloath, in the forme hereunder described. These you shall spread with the following Medicine, or steepe them in it. *Recipe puluerum Mastich; sanguinis draconis, thuris, farine volatilis, Tragacantha contuse, gypsi, picis, sarcocolla, ana dra. 1. picis nigra scruples 2. grain 5. albamina onorum quæ sufficient, fiat medicamentum.* These cloathes you shall lay vpon the face, at the opposite lips of the wound, so that they may be distant the breadth of a finger, and so suffer them to lie till they cleaue strongly to the skinne of the face. Then with a needle and thred, straine the indented opposite corners together so hard, that the flesh (to which they will firmly cleaue) may be drawne together with them, and so be revnited by such meanes as you shall finde to be fit. But be carefull with fit bands and tyes about the head to establish your worke, that it stirre not till you haue brought it to perfection. The fashion of the Indentures and their application is hereunder expressed.

The Figure of the dry Seame.



withall, hold the eye steady, that with a paire of small Pincers you may pull out that which offends, which sometimes will be fast fixed, or adhere close to the membranes. This Instrument must be so artificially made that according to the bignesse or smalnesse of the eye, or as you would haue it extended or drawne in, it may be made wider or narrower, at your pleasure. This is the forme of it.



and the very Naturall humour of the Eye issueth out. To auoyd this mischiefe, wee are constrained to vse the helpe of the *Seton*, which is often found to be a remedy (not in this disease onely, but in many others) and many examples I could bring of it, if I did not purposely command my selfe to be short as I may, I come therefore to describe the vse of the *Seton*.

Place the Patient vpon a foot-stoole, and bow his head downe-ward, to stretch the skin of his necke as much as you can. Then with your fingers separate the skin, together with the fleshy pannicle vnder it, from the muscles of the necke; then set on the tongues, so that the holes perforated in them, may stand vp and downe, not ouerthwart the necke. Pinch him hard, that the paine of the tongues or pincers may take away the sence of that which followes. Haue your probe ready three or fouresquare at the point, and immediately as bigge as a Goose or Swannes quill, crooked at the end, and red hot; that probe you shall enter into one hole of the pincers, and issue at the other; hold it in no longer then it hath made a good Eschar, then draw it out, and put in a needle made large for the purpose,

with

CHAP. VIII.

Of some offences of the Eyes.

WE spake last of the wounds of the face in the end of the last Chapter, wherefore here I will also prosecute some accidents which happen about the face also, and ad- solue what I haue to say, concerning it, yet so that I will meddle onely with such accidents as require the vse of the Instruments I haue to describe, to which in this small addita- ment I tie my selfe.

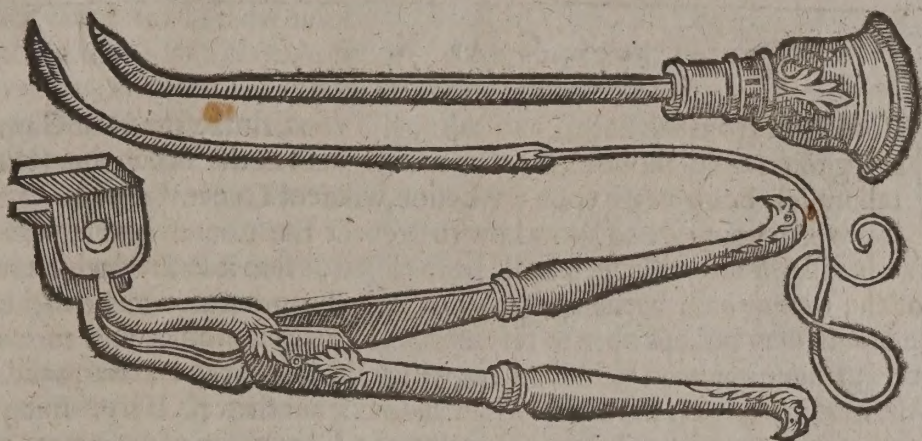
First therefore many small motes fall into the Eye which are some- times hard to get out, and being sharpe, or otherwise of euill quali- tie, breed an extreame and insuffera- ble offence. If by turning the eye- lid ouer the end of a *spatula*, you can- not finde that which offends, then you may vse the Instrument hereun- der described. You must insinuate it vnder the eye-lids next to the white of the eye, and so separate the liddes as farre asunder as you can without too much violence, and

Againe, the Eyes are often vexed with sharp and most impo- tunate Defluxi- ons, so that some- times the Horny coat of the Eye is broken therwith,

with a thicke fourefold thred of Cotton-wooll, or rather Sleauē filke somewhat twisted, and wet with the white of an Egge, and a little Iuice or infusion of Roses mingled together. After that, couer the wound with double cloathes, wet in the same liquor, and binde it vp. The next day annoint the necke with Oyle of Roses, and for a few dayes renew the double cloathes, moyfined as before; but the *Seton* or string which is in the wound, must be gently drawne to and againe, and rubbed ouer with this following Medicine.

Recipe Terebinth. Veneta ounces 2. syr. ros. & de absynthyo. ana drams 2. pulueris Treos, diacridij, Agarici trochiscati & Rheiba anagr. xv: incorporentur omnia simul & fiat medicamentum. And this must be vsed as long as you would keepe the wound open.

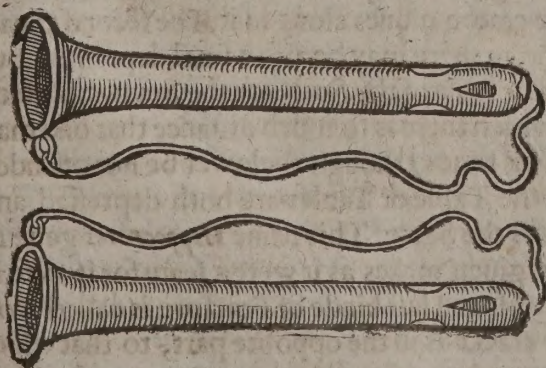
The Figures of the Pincers, Probe, and Needle, are hereunder expresse d.



CHAP. IX.

Of some offences about the Nose, and the Eares.

THe Nose as it is the chiefe beauty of the Face, if it be whole and proportionable; so if it be violated or deformed, it disfigures the face most, and therefore the Poet calls the wounds of the Nose, *inhonesta vulnera*. As if they did dishonest a man. Yet because the Nose stands out vpon the Face, and hath it selfe no defence, it is subiect to more outward iniuries then the rest of the parts about it. The vpper part of it especially, because it is bony, is subiect to bee broken, which when it happens, it may be thus amended. First, you shall frame or whittle a sticke somewhat broad at the end, like a little *Spatula*, and whip it about with Towe, or with a Clout, which you shall put into the nostrils, and therewith restore the bones to their right places and figure. Then with stupes or cloathes moyfined with an *Adstringent* Medicine of Masticke, bole *Armonia*, *sanguis draconis*, and burnt Alumē, made vp with the whites of Egges, you shall couer the sides of the Nose, for that will establisth them, and then binde it vp with a fit Ligature, not too hard, least you make the Nose crooked and saddled, which beside the inconueniences it brings with it, will be a great disfiguring to the Face. After you shall prouide two small pypes, or tunnels, not exactly round, but somewhat depressed with holes in the end, and about the end, by which the *Sanies* may issue, and also the breath may be drawne in and returned. At the outward end, let them bee a little more compasse, and a small ring fastned to them to tie a string vnto, which string you shall so fasten about the night-Cap, that the Tunnels may be held within the nostrils. These will containe the bones of the Nose in their due position, till the cure be perfected. The figure of them you haue hereunder expressed.



But if a part of the Nose be cut, and there be any quantity of flesh remaining, whereby the wounded part may receiue life and nourishment, it will be good to sew it vp, otherwise the wound cannot be restored, vnlesse it be by that quaint deuice of taking a new nose out of the skin of the Arme, with the description of which operation, I will not trouble my selfe nor you at this time; or a new nose counterfeited, as *Pareus* teaches.

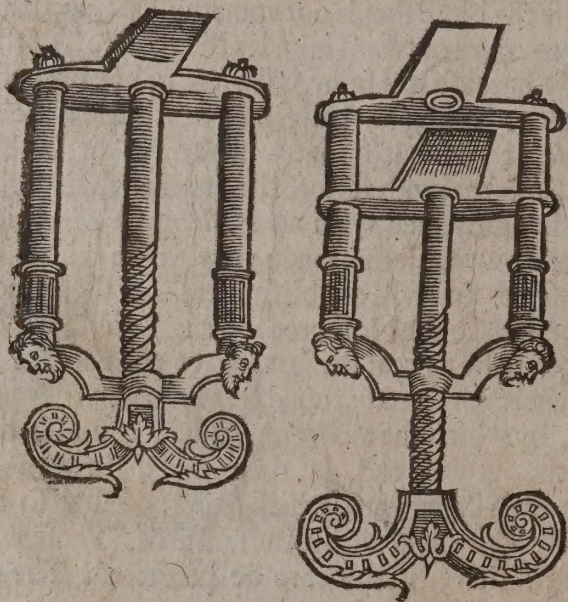
For the eares if the Cartilages be cut away, there

there is no hope of recovering them; but if the Cartilage be so cut, that some part of it hang by the skin, it may be sewed vp againe, yet beware you pierce not the Cartilage with your needle, for then it will gangrenate, but onely the skin, and as much of the flesh as you can take hold of, which compasses the Cartilage. The rest of the Cure must bee accomplished with Stupes, and deligations and such Medicines as may prevent inflammation and other accidents. But beside, beware that you defend well the hole of the Eare with a Sponge, least any thing get into it; for sometimes by such neglect, some small portion of flesh will grow into it, whereby the hearing will be depraued, if not viterly on that side lost.

CHAP. X.

Of the Convulsion of the mouth.

BEfore I goe from the Face, I must admonish you that the causes of Convulsions, being often about the head, which is the originall of the sinewes, and the temporall muscle being neare vpon the Lesion, whereof Convulsions doe often ensue, it is worth your care to know how to prevent the Convulsions of the mouth. For the Teeth will sometimes in such a case be so closed, that it hath beene knowne that the end of the tongue hath beene quite bitten off. To prevent which mischiefe, as also that the mouth may be kept open to receiue medicines fit for the cure of such a disease, the Chirurgians haue inuented an Instrument, which they call *Speculum oris*, whereby they can open the mouth, and part the Teeth wider and wider at their pleasure. But you must remember that when you perceiue any beginning of a Convulsion of the iawes, yea, when you haue reason to feare it will follow, if your Instrument be not at hand, put a sticke, a spatula, or some such thing betweene the Teeth, to hold them so farre asunder, that the tongue may not be violated, and that there may bee a way open to enter in the *Speculum*, which it will be hard to doe, if the Teeth be quite set, as we say. Heere you haue two of those Instruments delineated, the one close, the other dilated.



CHAP. XI.

Of the five sorts of Fractures of the head, and of the signes of a Fracture in generall.

HAuing done with the Face, we come to the Head, or rather to the Scull, which is subject to so many sorts of Fractures and Contusions, that it will take vs vp sometime to distinguish the into their kinds: which yet I will do as briefly as I can, & much more briefly, then a businesse of so great consequence should be handled, if I did not tye my selfe within so narrow cencels as I haue before prefixed. There be therefore five kinde of Fractures of the Scull. The first is called *Fissura*, a Fissure, or Cleauing, such as in an ear-

then pot or glasse when they are crackt, and the cracke runnes along in it. The second is called *Contusio* or *Collisio*, a bruise of the Scull, wherein there may be also a smal depression, but the bruise goeth on farther then the vpper shell or table of the Scull: for the Scull consisteth throughout of two Tables or Shells, betwixt which there is so much distance that one may be depressed especially in children, & in womens heads) though the lower be not offended. The third fracture is called *Effractura* when the Table or Tables are both depressed and shattered into pieces. The fourth is called *Sedes* the Seate. This name *Hippocrates* gaue it, because the weapon wherewith the blow was giuen, makes as it were a seate for it selfe in the Scull, and leaues his impression therein. The fift and last kinde of Fracture is called *Contra-fissura*, or the Counter-fissure, because the cracke is in the opposite part, to that which received the blow. All these kinde of Fractures haue some things common: especially the

the second, and the third, because they haue also many obseruations and Instruments particular and proper to these seuerall kindes, I thinke fit to handle them particularly, yet with my accustomed breuity. But before I come to the particulars, it shall not be amisse in generall to giue you the signes whereby you may know that there is a Fracture made. And these signes are of two sorts: some are such as doe perswade our reason, some conuince our sense. The signes that may reasonably perswade vs that there is a Fracture made, are these. If a man fall from high vpon a hard place, or if a hard and heauy body fall from high vpon his head. If vpon the blow he presently fall, but much more if the lye for a time deprived of speech, sight, and hearing; if the paine (after he comes to himselfe) be vehement and doe perseuere, so that he is constrained often to moue his head to the part affected: if when he awakes out of the astonishment he fell into vpon the blow, his minde or reason be not perfect but disturbed, his sight dimmed, and his head remaine giddy, as it is in the *vertigo*; if blood vpon the blow issue out at his eyes, nose, eares, or mouth, or finally if he vomit shortly after the stroke. The reasons why all these be signes of a Fracture, I must not here unfold, you must take my word for the present. You may also gesse shrewdly at a Fracture by the forme of the weapon, by the force wherewith the blow was giuen, if it were seene; if it were not seene, by the wrath or fury, or strength of him that gaue it, if his head were bare and without defence when the stroke came, and if it were downeright and not sidelong.

All these and many other the like circumstances may leade a man that is vigilant, and hath as we say, his eyes in his head, to iudge whether there be a Fracture committed or not. For although some of these accidents may happen without a Fracture, yet if many of them come together, especially of those I named last, they will put the case out of doubt.

Paulus Aegineta hath another way to know whether the Scull be crackt or no; where the wound is, he remoueth the scalpe and the *Pericanium* from the bone, and knocks it with an iron Probe, and if from that knocking there result a dull sound, such as a crackt Pitcher yeelds, then he takes it for granted that there is a Fissure; but surely to distinguish such a sound by such a meanes, I take to be very difficult. *Guido* conceit sounds better, and beside limits the very place of the Fracture, yea, the extent of it, if it proue true. Let the Patient hold one end of a small cord hard betwixt his foreteeth, and the Chirurgian the other end in his hand, and straine the cord hard, and then moue it as you would doe the string of an Instrument, and in the very stroke, saith he, the Patient shall be admonished, where the Fracture or Fissure is, and the paine will make him point directly to the place. *Pareus* hath no faith to beleue this experiment, as hauing tryed it often and neuer found any certainty in it. Thus much for the signes which may perswade our reason; there be others which will conuince our sense, which we may see with our eyes, or feele with our hands, or with our Instruments which cannot deceiue vs. Among these is reckoned that of *Hippocrates* his obseruation, if the haire stand vpright and stiffe in the wound, if the Chirurgian can with his finger feele a roughnesse and inequality any thing sharpe in the wound vnder his finger, or a manifest depression of the Scull. If yet a man cannot iudge of the Fracture, he must make a decussate incision in the Scalpe, that is to say, he must cut it crosse, so as the incisions may meet in the midst of the place suspected, and lay the bone bare, and then if he cannot see the Fracture with his eyes, he must grope after it with his Instrument. This Instrument must neither be too slender nor too sharp, least if it happen to stick in any naturall inequalities of the Scull, it might deceiue vs; neither must it be thicke and blunt, least it might passe by and not offend at a small Fracture. If when this Instrument or Probe arrives at the bare bone, there be nothing to be felt but smooth and slippery equality, then there is no Fracture; but if the Probe meet with any roughnesse, especially not in the way of the Suture, then there is certainly a Fracture. Yet must the Chirurgian remember that sometimes it may happen that there is a Fracture euen in the place of the Suture, and then it is hard to be discerned, vnlesse it be a very great Fracture, because the roughnesse of the Suture hides it, in which case *Hippocrates* himselfe confessees hee was deceiued. And beside, in some bodies the sutures are more close, in some more open, in some more equall and smooth, in some more vnequall and prominent. All these things the ocular Chirurgian must waygh in his minde, and with them compare the reasonable signes before mentioned, and so doing, it is not likely he can be deceiued. Thus much of the differences and signes of Fractures in fauour of yong Arts-men, though it be beside my intention. Now I proceed to the particular sorts of Fractures.

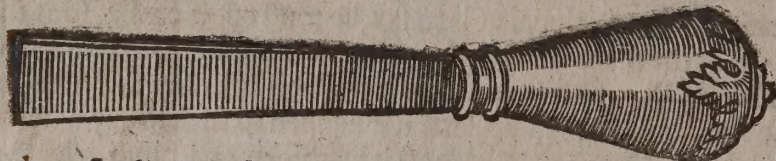
CHAP. XII.

Of Fissures of the Scull, the first kinde of Fracture.

He first sort of Fracture of the Scull, is the Fissure, which when the Chirurgian shall know to be committed, and yet the wound in the Scalpe is not large enough for him that he may dexterously apply himselfe to the cure of that Fissure, then he shall first shave off the haire as wide as he shall thinke fit, and with a Lancet or Incision knife, diuide the skinne and *Pericranium* from the bone, in a three or foure cornered incision, that is, thus T, or thus X, and to that magnitude which he shall destine to himselfe; but yet he must be carefull as neere as he can to auoyd the place of the futures, and especially the Temples. Neither let him make any scruple thus to make way for his worke, for it is a lesse detriment to wound the skinne (though it proue there bee no great need of it) which hee may easily heale vp againe, then to be ignorant of the nature, kinde, and extent of a Fracture, for want of seeing his way before him. This Incision he may make with a Lancet or Penknife, as we call it, or an incision Knife, the figures whereof, though you haue expressed before in the first Chapter, yet I haue thought fit here againe to discipher.



But whereas I told you that you must make your incision in the Scalpe cornered, you may provide that the wound which was made with the blow, may fall in as it may to make vp the corners of your incision. Alwayes provide that your knife be sharpe, and your hand so heauy, that together with the hairy Scalpe, you diuide also the *Pericranium*, and presently separate it cleane from the bone; for if it remaine vpon the bone, and come afterward to be torne by the Trepan, being of exquisite sense, and so neere of kinne to the *Dura mater*, that it is thought to be a production thereof, it will induce vehement Feuers and other Symptomes. Wherefore beginning at the inner corners where your incisions met, raise it vp with such an Instrument as is hereunder delineated.



When the *Pericranium* is well separated, fill the whole wound with pledgers of fine Lint, to keepe the lips

farther asunder, and aboue it apply remedies to stay the fluxe of blood, which if it cannot be stayed with medicines, and that you can find some notable branch of a veine by which it issueth, enter a needle with a thred on the outside of the Scalpe, and returne it againe from the inside outward, so that the thred may crosse the vessel, & then with the two ends of the thred w^{ch} are now on the outside of the scalp, tye a knot as straight as you think fit, to twitch vp the veine, which you would stanch: but betwixt the thred and the Scalpe, you must enterpose a rowle or pledget of Lint for a boulder on both sides, that the straining of the knot may neither cut the flesh, nor offend the skin, and breed more paine then is necessary; when you haue so stanchd the blood, leaue the head boulderd vp. And such a stitch is sometimes of absolute necessity, as when an Artery is wounded, for then no restrictive or binding poulders or medicines would doe the feat. And we finde in daily experience, that in outward parts, as well as in inward, we shall light vpon an Artery of some largenesse, where we did not dreame of it; so various is Nature many times in the diuersifying of the vessels. At the next dressing (which would be next day) the Ligature need not be loosed, and

and yet it will be time for the Chirurgian to resolve himselfe whether there be a Fracture or no, and of what kind it is. If he cannot find the Fracture let him wet the bare bone with writing Inke, adding thereto a moment of Oyle of Roses, and if there be any chinke or cleft in the bone, the Inke will pierce into it. The next dressing he shall carefully cleare the Inke from the bone with Lint, and then with an Instrument which they call *Scalprum* or *Radula*, made of Steele, with a head like a *Compasse Chesill*, or like a broad Arrow head, or like a hooked Chesill returned somewhat at the edge, he shall scrape or scale the bone, and if he finde that which he scrapes off to be blacke, it is a signe that there the Fissure is, because the Inke hath dyed the bone, and then he shall continue scraping till the dust come white, without any tincture of the Inke, for then he may presume he is past the Fissure. Sometimes the Fissure will guide him to continue scraping or scaling, till hee come to the very membrane or meninx: but if he would know before whether the Fissure be in both the Tables of the Scull, he shall try it thus. Let the Patient stop his nostrils and his mouth, that no breath issue out, and then let him strive to expire with all the power he hath; and if both the Tables be clouen, the Chirurgian shall perceiue a bloody *Sanies* to issue at the cleft, for the ayre so pent will make the meninx to swell, and a frothy moisture will sweat out. In such case the Scull must be scraped or scaled to the very meninx, yet great care taken that that be not touched. But if the Fissure be long, it shall not be alwayes necessary to follow the whole length of the Fissure with your scraper, for Nature will restore it of her selfe, if there be way enough made for the *Sanies* to issue, whereby symptoms are auoyded, and the corruption also of the bone. Within three dayes this worke would bee performed; yet if it happen that the Chirurgian be called later, he shall doe well indeed to tell the standers by of the danger (for most perish who are long neglected) but yet he shall apply himselfe to his worke, as if he had beene sooner called, because God and Nature doe often assist a diligent hand beyond expectation. But obserue that in Winter there is lesse danger of delay then in Summer, because the parts are in Summer more subiect to inflammation then they are in Winter. You haue hereunder diuers of these Instruments expressed of seuerall fashions, together with the handle by it selfe (for one handle will serue them all) whereinto the Instruments for more steadinesse must be scrued.

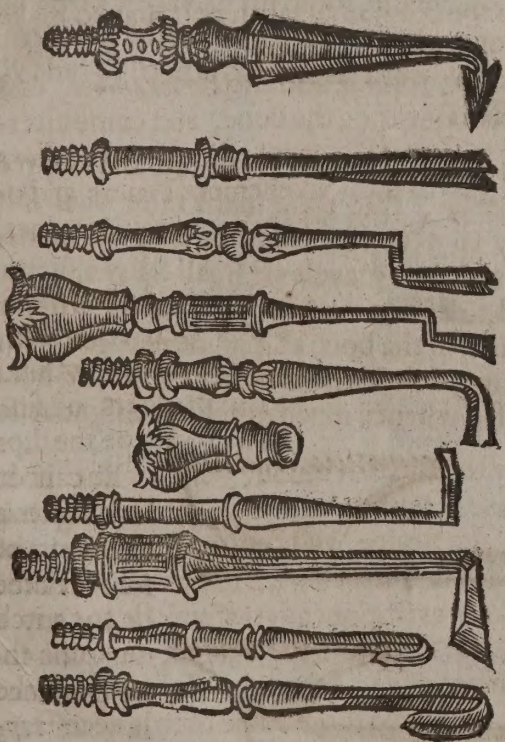
These two Instruments will serue for the scaling of greater bones. Thus much of a simple Fissure.

CHAP. XIII.

Of Contusions of the Scull, the second kind of Fracture.

A Contusion, which is the second sort of Fracture of the Scull, sometimes hapneth with a breaking of the skin, sometimes without. It happens without, when the Instrument wherewith the violence is offered, is obtuse & equall; Yet neuerthelesse there happens an *Ecchymosis* vpon it, that is, an effusion of blood gathered vnder the Scalpe, in the place of the

Contusion. If that effusion of blood be small, it may by fit medicines be discussed, but if it be great, so that the Scalpe rise from the Scull, it must be vented and purged by incision. Neither after must you vse suppurating Medicines, as in a fleshy part you should doe, because all moist things are enemies to the bones. This Contusion hapneth very often to children;



children, who cannot hold their feet; and beside, if they be metled, they are very busie, and get falls, and the Scalpe of their heads being soft, collects much such like serous and clodded blood. After the Incision and euacuation of this serous blood made by gentle Compression, you shall finish the Cure (if there be no Fracture) with drying medicines. But if vpon a great Contusion the Scull be depressed like the print of a bruse in a Brasse or Pewter-pot, so that you may feele the dint with your finger, you may expect a little (if the dint be not great) whether it will rise againe of it selfe, as it will do in the moist heads of children, women, and such as are phlegmaticke; but if it doe not rise, you shall set on a Cupping-glasse with much flame, and command the Patient that he stop his Nose and mouth, and then force his breath vpward; for by these meanes the depression may rise; if not, you must make Incision to the bone, and fasten vpon it a Wimble or Piercer with a screw, and therewith draw the bone vpward, till it be in his owne place, as Coopers vse to raise their Vessels when they are sunke too much downeward. But if the bone be so thicke or strong that the Wimble will not retract it, then you must perforate the Scull in the center of the depression, and vse the Leuer hereunder deciphered.



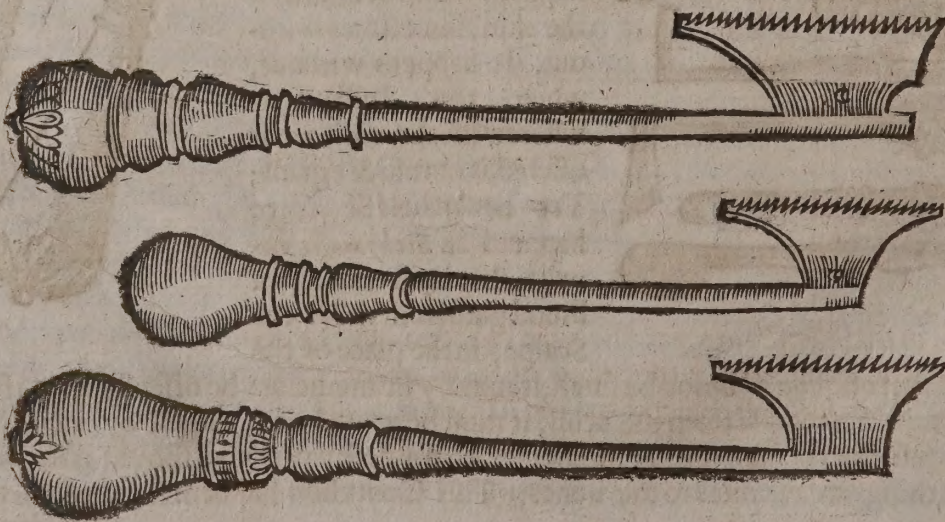
A, Shewes the point or tongue of the *Leuator*, which must be obtuse or blunt, that where it is insinuated as farre vnder the Fracture as the *meninx*, it may not offend it.

B, The body or steale of the *Leuator* which must be foursquare that the tongue fastned in it may be steady. The end of this steale must rest vpon the sound bone, that it may rest the firmer. The vse of it is, That when the point or tongue is vnder the depressed bone, lifting the Haft or Handle vpward, the bone depressed may be heaued vp.

C, Shewes the first arme of another *Leuator*, whose hooked end is by degrees insinuated vnder the depressed bone.

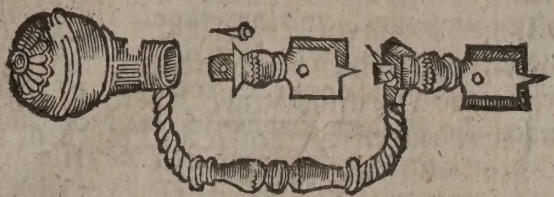
D, The second arme of this *Leuator*, which must rest vpon the sound bone, to assist the first in heauing vp the depression: but in the vse of this second *Leuator*, you must depresse the haft or handle, for so his first arme raises vp the depressed bone, whereas the handle of the first *Leuator* must be lifted vpward as farre as is need to raise vp the bone depressed.

But if it happen that the bone be fractured and depressed on one side onely, that thou maist raise that side and also make way to vent the *Sanies* or *ichorous* matter thereunder contained, thou mayest vse small Sawes, such as are here described, to diuide the Scull, and cut off without compression, so much of the bone as shall be needfull without danger of pressing downe the broken part of the bone vpon the *meninx*, frō whence much mischief might arise.



But if by such signes as haue been before related, or by any other, you shal be conuincied in your iudgment, that the Contusion is onely in the vpper Table of the Scull: You shal safely

ly take out that depressed part with a small Trepan, whose handle is like the handle of a Ioyners Piercer, but the Bit most like the Instrument whereby those that make Button-moulds doe turne them out of the wood. The handle and the Bit are here both expressed.



CHAP. XIII.

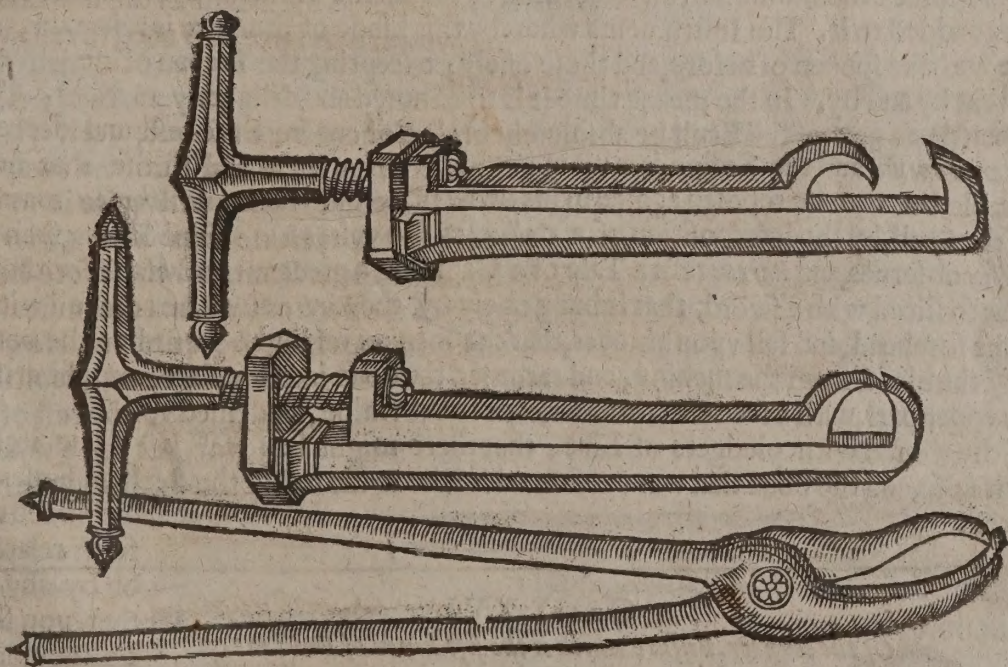
Of an Effracture of the Scull, the third kind of Fracture.



The third kinde of Fracture is called *Effractura*, that is, when vpon a vehement blow the Scull is not

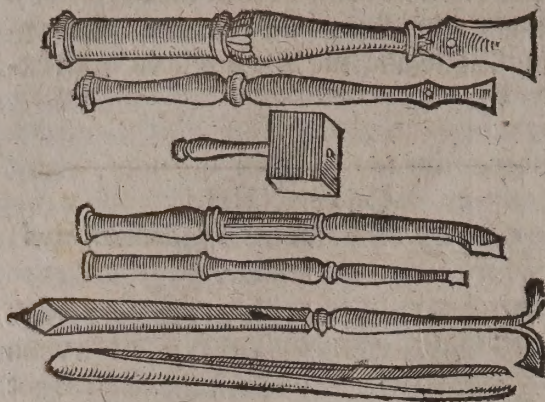
dinted onely, but sinks, and the Table or Tables are broken asunder, for so much the word signifies, and sometimes into many peeces; seven peeces of the Scull I saw taken out of a Childs head in the *Old-Lurie*, which the wheele of a Cart pressed against a wall, yet hee recovered. And because in this kinde of Fracture, the bones being separated and loose, may be taken out without trepaning, Chirurgians haue prepared small *Leuators*, whose formes need not be expressed they are so common; they be crooked, turned vp widely at each end contrary wayes, and a little broader at the end, as it were spooned, which spoone also is rugged and vnequall, to fasten better vnder the splinter which you would raise vp and loosen from the membrane; but on the embowed side they must be very smooth, for that side touches the membrane in the operation, and leanes a little vpon it.

But there must be great care had, least in taking away these shreds or splinters, we offend not the membrane, which oftentime is compressed, sometimes wounded by them: sometimes it happens that these splinters runne vnder the Fracture so farre, as they cannot be gotten out vnlesse it be enlarged. In such a case, if there be space enough to get one of these paire of tongues or pincers vnder the bone, you may snap off so much of it as will discover the splinter, and make way for the drawing it out, better a great deale, and with more ease and security to the Patient then you can vse the Tripan or Trepan. Beside, the businesse hath not so much circumstance, but may be suddenly done. Now wee know that to do a worke suddenly and securely, is of great commendation. The fashion of these tongues or pincers, or both, are herevnder described very accurately:



And because in these Fractures, not onely for the remouing and raising of Splinters, but also for the smoothing and making the edges of broken bones, and plaining them, there is vse of diuers sorts of Chisels, Pincers and the like; as also of a Mallet, you haue many fashions of them here described, that you may take your choyce, as you shall finde occasion to require.

For



For it must be considered, that as much as is possible, the Chirurgian ought to auoyd, not onely the hazzard, but even the offence of his Patient, and if he can take vp and separate the broken bones with a simple *Leuator*, let him neither vse the Pincers nor the Tripan. If the Pincers will serue let him not vse the Tripan, for it hath been obserued, that in vsing the Tripan sometimes, where there hath been no necessary vse of it, so much of the Scull which was but split, hath been loosned, as hath induced terrible consequences, which might haply haue been auoyded, if that hard

course had not been taken; for as I haue said before, Nature many times takes vpon her selfe and perfects such cures, as if an Artist should meddle with, he would spoyle all: For it is not for nothing that God hath prepared that *Meditullium*, a bloody and alimentary substance betweene the Tables of the Scull, but that by it as by marrow baked into a callous substance, the diuisions of these bones might be vnited. Wherefore my counsell is that the Chyrurgian should bee aboue all things carefull that there be way made for the euacuation of the *Sanies* or corrupt matter in euery Fissure and Fracture, but otherwise, that he striue not too much to bare the meninx, nor in deed more then he must of necessity doe, prouided that he leaue no inequality or asperity of the bone to grate it.

CHAP. XV.

Of the Seate, the fourth kinde of Fracture.

The fourth kind of Fracture is that, in which the weapon so sits in the Scull, that the Scull carries the print of it, neither longer nor shorter, and therefore *Hippocrates* (a happy Author, not onely of things, but of names also) calls it *Edo. Sede* the seat, for as a Hare settles in her Forme, so the weapon settles in the Scull, and leaues his impression in it, *ad amussim*. The seates are of diuers kinde, some superficially, some are impressed to the *medetullium*, some depresse both the Tables, some are long, some short, some broad, some narrow, according to the forme of the weapon, and the force which was added to it. The Instruments whereby this kinde of Fracture is releued, are the same we haue spoken of before, and those onely; excepting the Trepan of which wee shall intreat by and by. In the meane time it is to be noted and diligently marked; That if it happen that a part of the Scull be absolutely broken or cut from the rest, yet if it hang to the *Pericranium* and the Scalpe, it must not be pulled from them and throwne away as vnprofitable, but may be reposed againe in his owne place and Nature will vnite it to the bone of the Scull, by the interposition of a *Callus*, as she vnites the skinned by a *Cicatrice*. This *Celsus* obserues, and *Pareus* tells a Tale of a *Capsaine*, a great part of whose fore-head-bone, was so sliced with a sword, that it hung onely by the *Pericranium* and the musculous skin of the forehead, and fell vpon his eyes, that the meninx might be seene bare. He clenched away the blood from the meninx, and returned the bone into his place, and established it in the vpper part, with a seame of three stiches to the scalpe, and filled vp the rest of the sides of the wound with pledgets of Lint, that there might bee way left for the *sanies* to vent it selfe, and the bone that was cut fastned it selfe to the rest of the Scull, and the man recovered.

CHAP. XVI.

Of the counter, Fissure which is the fift kinde of Fracture.

Inally it hapneth sometimes that there is a Fissure in the opposite, or contrary part of the Scull, to that which receiueth the blow; so that if the blow were vpon the right side, the left is clouen, & on the contrary. This kind of Fissure is by so much the more dangerous, by how much it is harder to finde. *Paulus Aegineta* laughs at *Hippocrates* for making mention of it, and his reason is, because, though an empty glasse or pot, may be after that manner counterclouen, yet the hard and full Scull cannot

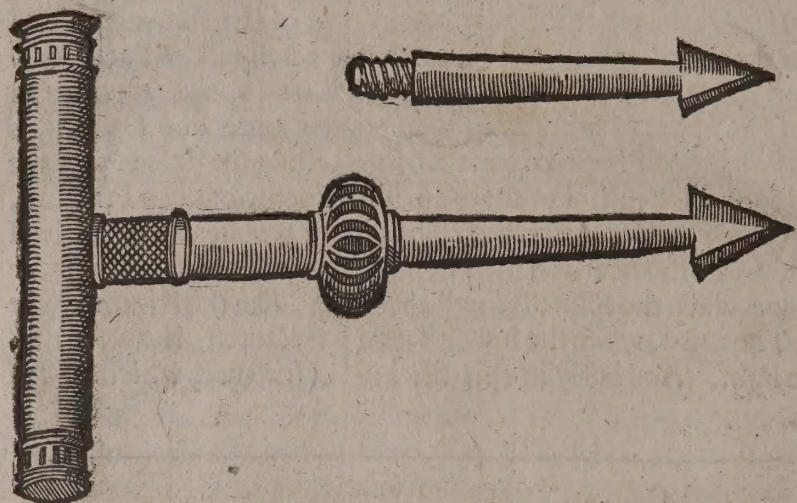
cannot as he conceits. But *Pareus* auoucheth that he hath seene it, and calls it *Resonitus* and *Contrafissura*: but withall saith, that it hapneth when the futures of the scull are obliterated, and the Scull growne to be all one bone, or at least when the futures are very close. Moreouer, he is of opinion, that *Hippocrates* meant also that the same bone of the Scull may receiue the stroke in one part, and be fractured in the opposite part; although the futures be naturall, and as they ought to be: but you must conceiue that the part opposite to the blow in the same bone, may be vnderstood two wayes. First, when the fracture is in the same superficies of the bone whereupon the blow did light, as if the blow did alight vpon that part of the *bregma*, which is next the *Lambda* future, and the fissure happen in the part of the same *bregma* which is next the *Coronall* future. Secondly, when the vpper superficies or Table of a Bone receiued the blow, and the nether table of the same bone, is cloven, of which kinde *Pareus* tels a story of a Knight who belonged to the troope of Horse, vnder Duke *Stephanus*. His discourse you may see in the eighth chapter of the ninth booke. The cure of this kinde of Fracture *Hippocrates* himselfe, who first wrote of it, pretermitted, because he could not conceiue how it should be discovered, and therefore for the most part it proued mortall. But *Pareus* would not haue it so neglected, but where by coniecturall and the rationall signes before described, it may well be suspected, he would haue the haire of the head shaued close, and a plaister put on made of Tarre, Pitch, Waxe, Turpentine, *iris* and Mastich duly mingled. If vpon the vse of this plaister any part of the skinn become moist, soft and tumified, vnder that he imagineth the Fissure is, especially if the Patient vn-awares, as it were, and without manifest sense of paine doe lay his hand vpon that part. In such a case, and where some of the signes of a Fracture before mentioned doe second his conceit, he calls in the helpe of a learned Physitian, and then fore-telling the danger that the Patient is in, he sets a Trepan vpon the Scull. For there are foure conditions of a Fracture, wherein the Chirurgian may easily be deceived, and thinke there is none, when indeed there is a Fracture. The first, when the Scull is lightly depressed, and shortly riseth againe into the due figure. The second, when the fissure is small and hairy, like the rift in a glasse which yet will hold water. The third, when the lower Table is fractured, the vpper remaining sound, at least to the sight. And lastly in this fift kind of fracture, which we call a counter-fissure or *Resonitus*.

CHAP. XVII.
Of the Trypan or Trepan.

HAue often before made mention of the Trepan, an Instrument by which a peece of the Scull depressed, or otherwise fractured, may be turned out. There are foure things which perswade a Chyrurgian to vse the Trepan. The first to raise vp a depressed bone, when the Piercer before spoken of will not serue the turne, and beside to take out the fragments of broken bones, who doe presse or lye hard vpon the membrane, or the substance of the Braine. The second, to make way that the blood and ichorous matter, which vpon the breaking of a vessell, floweth vpon the meninx, may be washed, dried vp, or otherwise vacuated and consumed, which would corrupt not the membrane onely, but the braine it selfe. The third, that the way may be made more open and plaine, for the application of such remedies as are fit to expedite and make the cure more facile and easie. Lastly, and especially this Trepaning supplies the defect of bands and swathes to inhibit the fluxe of blood, which cannot be vsed in fractures of the Scull for many reasons; first, the Sphericall figure of the head will not hold a swathe, vnlesse it be too straight and fast: beside, the thicknesse and hardnesse of the Scull will not suffer the Vessels to be straightned with any swathe or band, so that a notable flux should be stayed or inhibited: as for the vessels of the Scalpe which are without the Scull, the compressing of them with any Ligature would breed vehement paine and inflammation. For such a compression would intercept the pulsation of the Arteries, and keepe in the effluxion of these footy excrements, which vsually exhale by the futures. Moreouer, it would constrain the blood from without inward vpon the membranes, and consequently vpon the braine it selfe, whence the feauer, extreame paine, convulsions, apostemations of the Braine, the palsie, the apoplexy, and death it selfe would soone follow. These be the causes why the Trepan is more necessary in the fractures of the Scull, then in the fractures of other Bones of the Body.

But

But before the Trepan is set on, you must set the Patient, especially his head, in a fit posture, and prop it vp with swathes and pillowes, that when you come to your worke, it cannot sinke; as also that as little outward ayre as is possible may attaine vnto the wound, or the membrane in the trepaning; for there is nothing more enemy to the Braine then cold. Now we know that the warmest ayre in the hottest Summer day is farre colder then the membranes or the Braine, and therefore expert Chirurgians, when they goe about such a worke as this, beside the muniments before spoken of which they place about the skull; they also provide Chafindishes of coales neere hand, that no cold ayre pierce at the wound or trepaned part. Obserue also that the eares of the Patient must bee well stopped with Lint or Bumbast, as well that no blood nor any of the medicines which are vsed, doe get into the eares, as also that the hole of hearing being so cloyed he may not heare the noyse of the Trepan or other instruments which haply might affright him. Finally before the Trepan be set on, it will be fit to drill a hole in the Scull, with a three-square Wimble, in the place where the center of the Trepan must be fixed; and therefore the point of that Wimble must be no bigger then the point of the center of the Trepan is: Such a Wimble you haue hereunder demonstrated.



A, Shewes the handle of the Wimble.

B, The Bit whose head is serued into the handle and pointed three-square.

The Trepan it selfe is a round Saw, with a center or point in the midst, which being fixed in the bone, the circumference is mooued,

and cutteth out a peece of the bone as bigge as the circumference is. They are made of diuers magnitudes for the diuers vses there may be of them. They are framed of many peeces. A Steale or Handle, much like that of a Ioyners Piercer to be turned round. The round Saw it selfe with a hollow shanke, wherein the center or three-square point is contained; a round case for the Saw, which standeth a little off from it, and hath no teeth in it, for it is made to guide, limit and proportion the descent of the Saw into the Scull, that it touch not the membrane. There is also a Vice set vpon the shanke of the Saw, neere the head of the Handle, with a small shanke in the side of it, whereinto they put a scrue Pinne, to hold the shanke of the Case wherein the Saw runnes firme and stable that it moue not. All these particular parts and peeces of the Trepan are seuerally and particularly delineated in the figure following; and beside you haue also a pourtraiture of the whole Trepan with all the parts ioyned together, that in one peece you may see how to ioyne all into one Instrument, and how to take the parts asunder.

A, In the Figure to the left hand, sheweth the whole Trepan, with all the parts ioyned together.

B, the head of the handle in which the Saw is fastned.

CCC, the shanke of the Saw.

D, the Saw taken from his Case.

E, the Vice.

F, the screw which fastneth and firmeth the Saw to the Handle.

G, another screw which fastneth the Vice to the shanke of the Saw.

H, the Center or Point of the Trepan.

A, In the figure to the right hand, sheweth the whole handle of the Trepan.

B, the Case of the Saw.

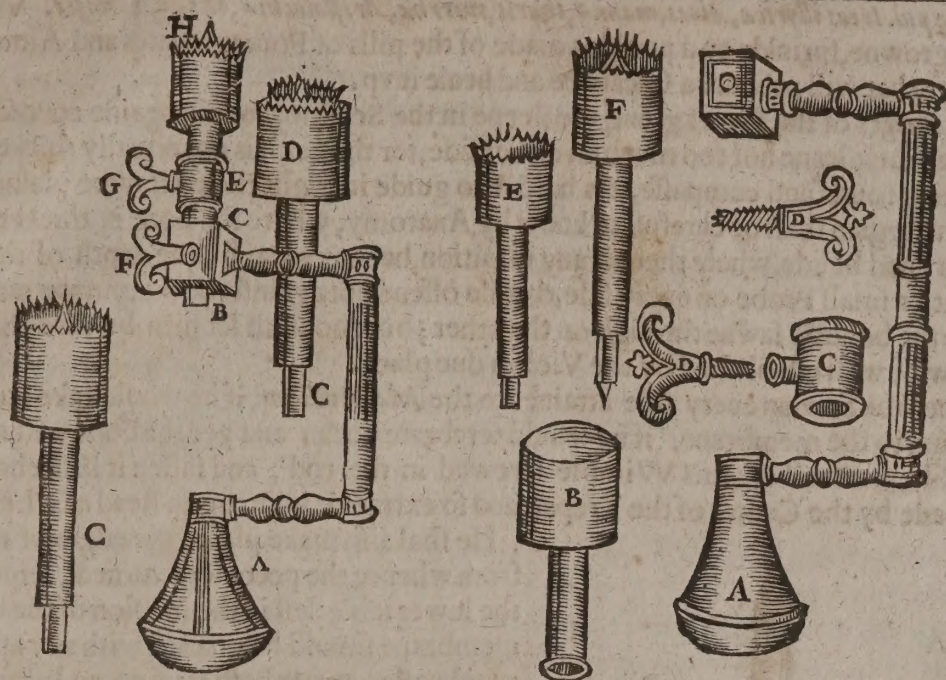
C, the Vice.

DD, the Screwes which firme the Vice of the Saw.

E, the Saw without his center or point.

F, the Saw furnished with his Center or point.

There



There is another sort of Trepan or Trefine, now generally in vse amongst our *London* Chirurgians, called the hand Trepan, the head of it is made Taper fashion, smaller at the teeth, and greater vpward, with cutting edges round about on the outside, to make way for it selfe; the shanke of the head entreth into the sockets of a straight stemme, and is made fast into it with a screw: the handle is made crosse the top of the stemme, like the handle of a Gimblet (but longer) and both ends made in the forme of an *Elevatorie*, and serue (the perforation being made in the Scull) to eleuate the depressed bones. This with a semicircular motion of the hand, performeth the operation with great security, for the perforation being made it cannot slip in to endanger the hurting of the *dura mater*, as the other may doe: they that will may vse this head, with the handle turning round like a Piercer before described.

Now you know the forme and fashion of the Trepan, I will acquaint you also how you shall vse it.

When you haue bared the bone, washed the head, drilled a way for the center, fastned your Trepan therein, and screwed the Case to that depth, which you would haue your Saw to cut, then with a Wimble and steady hand, winde about the handle, till you haue cut away the first table of the Scull to the *Meditullium*, and entered the teeth of the Saw in the second, but entered them onely. Then take out the Center or point, and set on the Saw againe without it, for feare it should touch or perforate the meninx; for that were dangerous if not mortall. But the center being gone, you may safely turne out the second table even to the membrane, for the case, if it be duely fastned, will keepe the saw from entering deeper then to the membrane. You shall also annoint both the Saw & the Case with Oyle, that they may runne more glib and glad, and cut more sweetly. For so you see Carpenters vse to annoint their Sawes with some fresh-grease. Moreouer, *Pareus* would haue you dip your Saw and the case in cold water, whilst you are in the worke of terebration, because they will grow hot in the circumaçion, but I conceiue this will doe more harme by interrupting the operation, then it will doe good, vnlesse the worke were to continue some long time, and the circumaçion were extreame quicke, neither of which are to be feared in this businesse. The next of his obseruations is of more consequence, and that is about the scaling of the bone. For where either the Trepan toucheth, or the ayre taketh the bone, it will surely scale, and this scaling may be accelerated by sprinkling a like poulder of Rocket, Brionie, wilde Cucumer, and *Aristolochia*: but the Chirurgian must not pull off the scale, but suffer it to fall of it owne accord. When the bone is scaled, to regenerate hard and

Recipe pul. Ireos illyrica, Aloes, manna, thuris, mirrha, Aristolochia, ana dr. i. misce. When the flesh is growne, sprinkle on a poulder made of the pills of Pomegranates and Alume, burnt together, that will procure a Cicatrice and heale it vp.

The danger of the Sawes going too deepe in the Scull, makes me againe counsell you to beware that it leane not too much on either side, for the Scull is not equally thicke, and beside, being round and compasse, it is harder to guide it aright then if it were plaine, where the Chirurgian shall be carefull to know by Anatomy, where the bone is thicker, where thinner; and beside, where there is any suspition, he may measure the depth of the Sawes cut, with a small Probe on euery side, that he offend not against the membrane on one side, before the bone be sawne through on the other; but about all let him be sure the case of his Saw be well established by the Vice in due place.

When the Saw on euery side attaines to the *Meditullium*, if he would take out but one table, and to the membrane, if he would terebrate both, and yet the bone will not come out easily, you shall vse this Wimble serewed in the end, and fasten it in the hole which was made by the Center of the Trepan, and so extract it with this in stead of a Leuator.



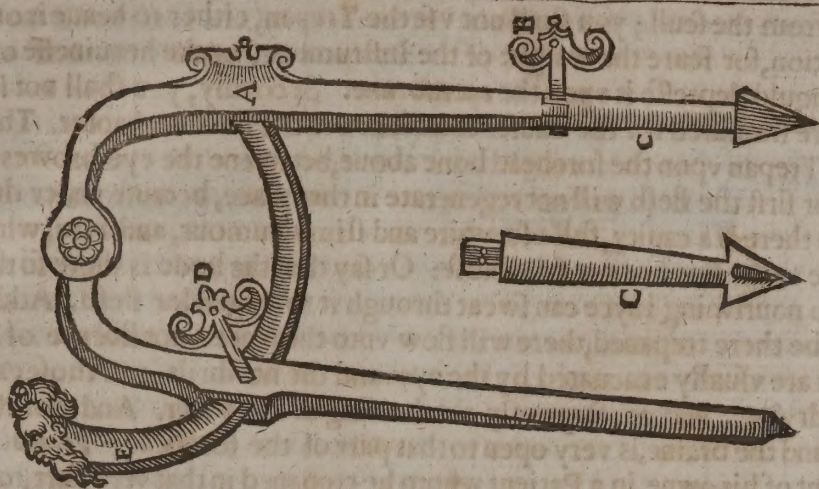
He shal also make plaine the edges of the Scull, from whence the peece was turned, especially of the lower table, lest in the incision of the braine, the membrane should be goaded with any asperitie or roughnesse. *Pareus* hath framed an Instrument for this purpose, me thinkes with a little too much circumstance, for I thinke a paire of Pincers will doe it as well. But you shall finde his Instrument in the 18 chapter of his ninth booke. If the asperity be any thing thicke, he flies to the Chisell and Mallet but he would haue it of Leade. As for the small fragments and splinters of bones, if any fall vpon the membrane or sticke in it, they may be taken out with a paire of small Pincers.

But if that part of the Scull which is fractured will not safely admit the incision of the Scalpe to make bare the Bone as farre as need doth require, as when the fracture is vnder or neere the temporall muscle or vpon the future, then in stead of one large Trepan, you may set two or three small ones, if it be needfull, not vpon the fractured part but neere it, and so that the gutter of the second may ioyne with the gutter of the first, and the third. But if the fracture happen vpon the future, set two trepans vpon the sides, on each side one, otherwise you shall teare the sinewy fibres, membranes, veines, and arteries, by which the meninx is tyed vp to the Scull, and yeeldeth his productions for the forming of the *Peritoneum*. Againe, if you should thinke that one trepan, or one of the futures would be sufficient, you would be deceiued, because the *sanies* which vpon the fracture falleth on both sides of the future vpon the meninx, cannot haue vent, or be exhausted, because the fibres of the *dura meninx*, which rise through the future to forme the *Pericranium*, are as it were a partition wall, or hedge to stay it from issuing from that side of the future that is not trepaned, to that side which is trepaned.

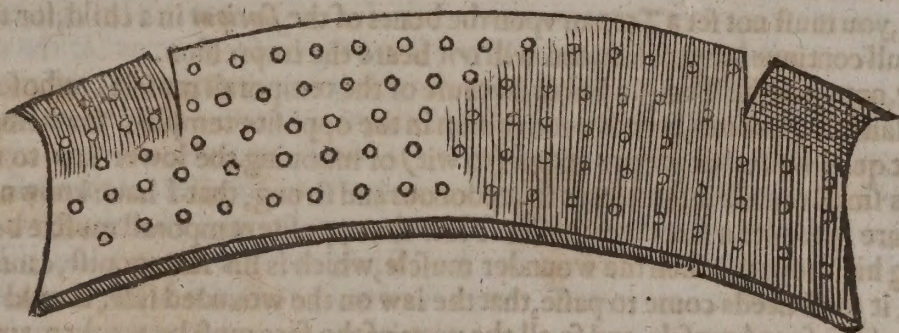
To conclude, if for any reason you be willing to forbear the Trepan, you may vse another instrument, called the cutting Compasses, but the bone must be laid as bare as it should be for the Trepan. These Compasses you may separate more or lesse as you please with a Screw that goes betwixt their shankes; and the point of them, which is made to cut, you may also alter at your pleasure, hauing diuers of them in a readinesse, which you may fasten to that shanke with a Screw.

A paire of cutting Compasses to turne a bone out of the Scull.

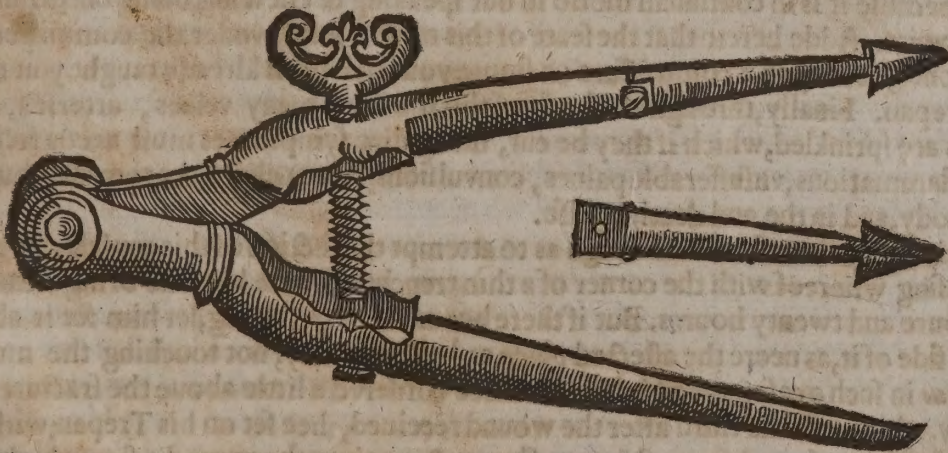
- A, Sheweth the cutting shanke of the Compasses, which as it is wound about cutteth the Scull. CC, Two points, either of which at the knee you may fasten to the shank with a Screw, as they be fittest for your vse.
- B, The Screw which fastneth the cutting point of the Compasses to the shanke, which you may call the knee. D, A great screw which holds the Brace of the Compasses to the other shank of the compasses, which makes the Compasses wider or narrower at your pleasure. And



And because in this worke one of the shankes of the Compasse must stand firme in a certaine place whilst the other winde about to cut out the bone, it shall be fit to provide a plate of iron punched with many small holes, but not perforated, in which holes the standing shanke of the Compasses may rest without any wauering; and you must also make the plate a little curued, and hollow, that it may comply with the roundnesse of the Scull. The fashion of the plate is hereunder expressed.



You may also make your cutting Compasses with a head as ordinary Compasses are made, and the Screw whereby they are made wider and narrower, may be made round and long, to reach betweene the shankes, neere the head of the compasse. And this fashion I like better then the former, for the screw is surer, and therefore I haue caused it to bee hereunder described.



CHAP. XVIII.

Of the places of the Scull which will not beare the Trepan, of the temporall muscle, and off fungous flesh.

BEfore we part from the vse of the Trepan, it shal not be amisse to exhibite in one chapter (though we haue touched vpon some of them before) all the places of the Scull, which will not admit of the vse of the Trepan. First therefore, if the fractured bone be altogether, or for the most part, bee by the violence of the

blow, separated from the scull; you shall not vse the Trepan, either to heaue it out, or to finish the separation, for feare the waight of the Instrument, or the heauineffe of his hand that guides it, should depresse it vpon the membrane. Secondly, you shall not set the trepan vpon a future fractured for the causes mentioned in the former chapter. Thirdly, you shall not set the Trepan vpon the forehead bone aboue, betweene the eye-browes and neere about them. For first the flesh will not regenerate in that place, because vnder that part of the vpper Table there is a cavity, full of a white and slimy humour, and ayre, which reacheth on either side to the five bones of the Nose: Or say that the bone is there so thicke, fast, and solid, that no nourishing luyce can sweat through it to engender flesh. Adde hereto, that if the bone be there trepaned, there will flow vnto the place a confluence of those excrements which are vsually euacuated by the eyes and the nostrils, and those excrements will hinder the drying, and consequently the healing of the Vicer. And that the passage out of the nose and the braine, is very open to that part of the forehead, *Parvus* confirms by an experiment of his owne, in a Patient whom he trepaned in that very part, for saith he, when he shut his mouth and his nostrils, and yet did strongly expire, the ayre that issued at the trepaned place, would blow out a good great Candle. And in this place the bone in some bodies is much depressed naturally, in all bodies somewhat; so that the Chirurgian may mistake it for a depression vpon a fracture, if that part happen to be wounded, or sore brused, ylesse he haue this obseruation in his minde.

Fourthly, you shall not set the Trepan neere the lowest edges of the scull, least if there be a way open, the soft substance of the braine, pressed with his owne waight, should sinke downeward to the orifice.

Fifthly, you must not set a Trepan vpon the bones of the *sinciput* in a child, for those bones of the scull continue longest soft, and will not beare the impression.

Lastly, not vpon the Temple-bones, because of the temporall muscle, whose section or incision, saith *Hippocrates*, breeds a convulsion in the opposite temple, for being cut ouerthwart, it quite looses his proper action (to wit) of moouing the lower iaw to the vpper. And this small muscle is sometimes so tendonous and strong, that I haue known a man who could share in sunder a fixepenny naile. Now the opposite temporall muscle being found, and vsing his strength, when the wounder muscle, which is his Antagonist, cannot moue against it, it must needs come to passe, that the iaw on the wounded side, should follow the traction of the sound muscle, and so all the parts of the face must be writhen, tortured, and conuelled toward the sound side, the wounded muscle being resolved. For it is *Hippocrates* his rule, that when there are muscles (as he calleth them) *Congeneres*, in opposite parts, which are of equall number, magnitude, and strength, the resolution of one part brings the convulsion of the other.

Neither doth this mischiefe onely follow the wounding of the temporall muscle, but moueouer, because it is in continuall motiō in our speaking & chewing, being once diuided it cannot reynite. Adde hereto that the seate of this muscle is iust vnder the commisure of the stony bones; now vpon a commissure or suture you haue been already taught you must not set a Trepan. Finally, through the body of this muscle, many veines, arteries, and more sinues are sprinkled, which if they be cut, many dire symptomes must needs follow, a feauer, inflammations, vn sufferable paines, convulsions, not onely of the temple, but of the whole body, and in the end death it selfe.

Let no Chirurgian therefore be so rough as to attempt the section of this muscle, the pricking or brusing whereof with the corner of a thin trencher, I haue knowne bring death in lesse then foure and twenty houres. But if there bee need of trepaning, let him set it aboue it, or at the side of it, as neere the affected place as he safely may, not touching the muscle it selfe. *Parvus* in such a case, made his incision three cornered a little aboue the fracture, and the next day, which was the third after the wound receiued, hee set on his Trepan; within a few dayes after he tooke out foure shiuers of bones, & put into the wound a smooth pipe of Lead, with two holes in the end; euery dressing commanding the Patient to stop his mouth, and his nostrils, and to expire with all his strength, holding his head downeward, so by that pipe much matter came away, which was collected betwixt the Scull and the meninx. The other superfluties he washed away with a sponge filled with a detergent decoction, and at length cured the Patient through Gods assistance. The figures of these two Instruments are in the next page deciphered.

The pipe of Lead smooth and broad in the end, by which the Sanies was gotten out.
The spring wherewith the wound was washed.



Another story he tells, which I will insert, because of the cure of proude and fungous flesh. A mans Temple-bone was fractured with the sliuer of a stone, he fell vpon the ground, and blood issued out of his mouth, nose, and eares, he vomited exceedingly, and lay mute and astonished foureteene dayes, he was full also of convulsions, and his face was puffed vp. He was trepaned in the fore-head-bone, at the side of the temporall muscle, The five and twentieth day, a soft spungy flesh of exquisite sence, grew out of the hole made by the Trepan, whose growth no Cathetericall poulders could prohibit, yet at length he recovered. We call this fungous flesh, because it is soft and like a Mushrome, is narrow at the root, and growes broad at the top, and doth increase or diminish according to the affluence of the matter, or the industry of the Chirurgian, in intercepting it: it smells abominably, they call it in *France* Saint *Fiacers* figge. As in the barke of a tree, from the excrement of the aliment, a humour halfe rotten, thicke and glutinous, sweats through, and gathering together by degrees, is heaped vp into a Mushrome, so out of the broken vessels of the *dura mater*, and the scalpe issues blood of a melancholly temper and consistence, and is increased by that which Nature sendeth to repaire the flesh where it is decayed, and so it growes into a spungy protuberation, which therefore *Galen* saith, carries the condition of the place to which it growes: This spungy flesh is eaten away by medicines, which have a specificall quality to consume such superfluous flesh, such as are those which do dry exceedingly, but weare and eate away more moderately, such as that is which followes.

Recipe sabina drams 2. ocræ dram. 1. puluerizentur simul, aspergatur caro excrescens, or Recipe Hermodactylorum combustorum, 3 ℥. fiat puluis in eundē vsus. But if that spungy flesh (as often it happens) grow to be as bigge as an egge, then tie it as neere the root as you can with a thred of silke, and twitch the knot, till it fall off, and vpon the root strew the poulders before named, for so it will sooner die then by sharper Cathereticall medicines.

CHAP. XIX.

Of the Corruption and rotnesse of the bones of the Scull.



Sometimes corruption ouertakes the wounds of the head, and a *Sphacelus* the bones of the Scull fractured, which hapneth, because they are touched with the outward ayre, which they neuer before felt; or because the *Sanies* being concluded vnder them, putrifies it selfe, and rotnes them; or because the Chirurgian for want of skill, applies suppurating and oily medicines vnseasonably, whereby the bones lose their naturall temper, and become ouer-moyst, contrary to their nature, and the neighbouring flesh is overheated and turned into quitture, which falling downe to the bone where it findeth stay, makes the vlcer foule and sordid, and by degrees fastens vpon the bone, a malignity whereby it suffers inflammation; yea, *Galen* hath it, that the beginnings of inflammation in the Scull proceed from the bone oftentimes. This mutation to a state against nature and corruption, which we call *Caries*, may be discerned by the eye, (to wit) when the bone turnes from white to be yellowish, or begins to grow blacke: partly also by the probe, which findes it rough, vnequall, not smooth as it was wont to be, and beside, when the rotnesse hath preuailed, the probe will finde it fungous and spungy, and sinke somewhat into it, or at least beare it before it, if it be a little pressed. Yet this last signe is not perpetuall, especially after a while; for the rotten humidity in time wil be dried vp, and then the bone wil grow so dry, that a Trepan wil hardly pierce it, and yet be carious too, but the greatest argument of a carious bone is when the flesh about it is too soft, and washy, and almost without sence: This *Caries* or rotnesse of the bone must be cured with *Cauteries*, either actuall, or potentiall, such a poulder sprinkled vpon the bone is auayleable.

R. Iræos, Flor. Aristol. ana dra. 1. Centaurij drās 2. Corticis pini 3 ℥. fiat puluis subtilissimus. But if the caries be much, you shal vse the scraping instruments before described in the 17 chap. And if it goe through the whole bone you shall not diuide the corrupted part from the

found, but suffer it to fall away of it selfe; yet may you be now and then moving it with your probe, for so Nature will sooner shoot it off, but I can limit you no time. As for the place of the Scull where the Trepan ranne, the bone that hath taken the ayre, that which was Cauterized, or whereon the Cephalicall poulders have been shed, they all commonly scale with forty or fifty dayes more or lesse, according to the difference of the age, temperament and habit of the Patient: and in the like proceffe of time a broken bone will vnite by a Callus, (which as I said) was to a bone, as a scarre or a Cicatrice is to the skiane.

Sometimes it happeneth that a part of the bone is tainted with a Caries or rottenesse, but the whole bone with a *sphacelus*, and falls away. And in such a case a Periwig may be artificially made to defend the head from outward iniuries, for the bone cannot be restored, neither can any plate of gold be so couched that the scalpe should grow ouer it, and he that tels not his Patient so, is an imposter, and will conuey the gold into his owne pocket.

CHAP. XX.

Of the mischiefs that happen to the dura meninx in the Fractures of the Scull.

IN the Fracture of the Scull, most what the fault of the Chirurgian in vsing the Trepan, and other Instrument, sometimes is the cause that the *dura mater*, or *meninx*, i. the membrane next vnder the Scull is violated by being cut or torne. The medicines to cure this fault are called *agglutinantia*, as if we should say, gluing, or sawdering medicines. *Paras* hath a good one which is this. *Recipe Colopho. dram. 3. myrrha, aloes, masti. dis. sanguinis draconis. ana dram. 1. croci ℞. sarcocolla dram. 8. misceantur & fiat puluis subtilis.* The other part of the cure which is to cleanse the wound from *Sanies* or any other rotten matter, gotten betwixt the Scull and the meninx, may be performed by a probe with lint, or rather a ragge rowled many folds about it, and wet with syrrop of Roses or wormewood, and a little *Aqua vita*; and this the Chirurgian shall doe every dressing, commanding his Patient to stop his nose and mouth, and then expire as fast as you can, that so the matter to be euacuated may rise, and the probe to meete with it. Moreover, because the meninx, if it be tumified vpon incision or laceration, will rise and haply be offended against the rough edges of the Scull which was cut with the Trepan or otherwise vnequally fractured, therefore you shall prouide for your probe, a round and smooth and broad head, wherewith you may gently depresse the membrane, that so the sanies may haue free vent: and this you shall also doe every dressing and then sprinkle on your sawdering powder, and after lay a sponge vpon it, moystned with a drying and corroborating decoction, and after well wrung. The decoction may be such as followeth out of *Paras*. *Recipe fol. salvia, maiorana, betonica, rosarum rubr: absynthij, myrtilorum, florum chamemeli, meliloti, stoechados utriusque ana m. 3. ℞. radicum Cyperi, Calami aromatici, ireos, Caryophyllatae, angelicae, ana 3. ℞. bulliant omnia secundum artem cum aqua fabrorum, & vino rubro fiat decoctio;* Or instead of this decoction you may moysten the sponge with Malmesey and a little *Aqua vita*. Above all put a plaister of *Diacalciteos*, but made liquid with vinegar or Wine, wherein Roses haue beene steeped. Remember alwayes that you passe no straight Ligature vpon the Scull, nor any thing which is heauy, or hard, for those things will breed paine and inflammation: and let the Patient, if he can, lie vpon the wounded side, and now and then hold his Nose and mouth close, and expire or breathe out as strongly as hee can, (as I haue before said) for so the sanies will better issue. Notwithstanding, let the Patient in the position of his head, finde his owne ease most what, for Nature it is who must perfect the Cure, and therefore molest her not too much.

Sometime vpon the vse of the Trepan, or otherwise the meninx may be inflamed and swell with a phlegmoue out at the fracture about the edges of the Scull, vpon which inflammation many grievous symptomes must needs ensue. Heere I would not haue a Chirurgian, though expert, goe alone but call for the aide of a Physitian: but the worke of the Chirurgian shall be to enlarge the orifice with his cutting Pincers, described in the foureteenth chapter; the Physitian may consult about bleeding, purging, dyet and the rest. In the meane time the inflammation may be mitigated with such a fomentation. *Recipe sem. Lini, Altheae, feniculi, psil. ros. rubr. ana 3. 1. solani, plantaginis ana M. 1. bulliant in aqua Cornuani & fiat fons.* You shall also instill into the eares *Anodine* and repellent medicines, or what else the learned Physitian shall prescribe. But if all this proceffe will not serue the vaine, but that there remaine a suspicion that there is some purulent matter concluded vnder

der the membrane, the Chirurgian with his Lancet shall diuide it, carrying the point thereof vpward, and outward, least he touch the *Pia mater*, or the Braine it selfe. For though this be a dangerous operation, yet many haue beene knowne to recouer with it, and in extreame dangers, extreame meanes are to be aduentured vpon, because without that helpe, death must of necessity follow.

Another accident may also happen, no lesse fearefull then the former, vpon a fracture. When either through the vehemency of the blow, or the coagulation of blood vpon the membrane, or because it hath taken the cold ayre too much, or through default of the Chirurgians medicines, not proper for the part, or finally because the proper substance of the membrane conceiues putrifaction, it may happen, I say, that the very meninx will become blacke. Here the Chirurgian had need haue his wits about him. If therefore the blacknesse proceed from the vehemency of the contusion, he shall powre vpon it a little oyle of the yolkes of egges, with a moment of *Aqua vite*, a chiue or two of Saffron, and a small quantity of the poulder of *Iris*, mingled with them. And then foment it with a fomentation made of discucient and aromaticall simples, boyled in water and wine, and aboue that *Vigo's Cerate*. But if the blacknesse proceed from congealed blood, bathe it with the following decoction, till the blacknesse vanish. *Recipe Aqua vite* ζ 2. *granorum tinctorum in tenuem puluerem tritorum dram.* 2. *B. croci* $\mathfrak{D}$ 1. *mellis rosati* ζ 1. *B. sarcocolla dram.* 3. *leuiter & simul bulliant omnia*. If it come from the coldnesse of the ayre that hath taken it, vse the medicine following till the membrane recouer his colour. *Recipe terebinth. Ven.* ζ 3. *mellis rosati* ζ 2. *vitellum oui vnum farine hordie dram.* 3. *Croci* $\mathfrak{D}$ 1. *sarcocolla dram.* 2. *Aqua vite dram.* 3. *incorporentur simul & bulliant paululum*. If it proceed from the inordinate vse of moyst and oylie medicines clense it away with dryers. If from the vse of biting and hot medicines, contemper it with such as are more gentle and coole. Finally, if it proceed from the putrifaction of the proper substance, *Vigo* vseth this medicine following. *Recipe Aqua vite* ζ 2. *mellis rosati* ζ 3. *B. misce*. And if that be too gentle, *Pareus* vseth the following decoction. *Recipe Aqua vite* ζ 2. *mellis rosati* ζ 2. *pulueris mercurialis dram.* 2. *unica ebullitione bulliant*. Or this, *Recipe Aqua vite* ζ 1. *B. syr. absynthij & mellis rosati ana dram.* 2. *unguenti Egyptiaci dram.* 2. *B. sarcocolla, myrrha, aloes ana dra.* 1. *vini albi odoriferi* ζ 1. *bulliant leuiter omnia simul, colentur ad vsum dictum*. But if the putrifaction be so stubburne and refractary, that it will not yeeld to these remedies, then vse *Egyptiacum* alone, but made with Plantane water in stead of vinegar, or you may vse the poulder of Mercury alone, or mingled with the poulder of Allum. For such medicines must not be balked in such a disease. And *Galen* saith, that if there be no phlegmoue, the *dura meninx* will well endure them. And two reasons may be rendred for it. First, because hard and dry bodies, such as are membranes, are not easily affected, but those things that haue a vehement operation; secondly, because it must be the Physitians chiefe care to conferue and restore the natue temper of euery part, with such medicines as are of temper alike vnto it. But if these medicines will not preuaile, but that the membrane swell aboue the Scull, and remaine black and dry, and the Patients eies become flaming, prominent, and wandring with iactations and a phrenzie, and that these mischiefes are not momentany, but stable and permanent, then hold thy hand and say, death is at the doore.

Thus haue I runne through the diuersities of Fractures of the Scull; the Instruments the Chirurgian shall vse in them, and many of the symptomes which accompany them; wherein I haue beene more prolix, because it is a noble plate and of great and frequent vse; yet I haue passed by many particulars, which out of expert Chirurgians and Physitians might haue beene added to excellent purpose. But you must remember that considering my first intention, this that hath beene said is a worke of supererogation.

CHAP. XXI.

Of wounds of the necke and throat, and of stanching of blood.

IN the wounds of the necke and throat, I will be but brieue; those of the necke, if they be but shallow, are easily cured, if they be somewhat deeper, they are more dangerous, because there are the tendons of many small muscles; but if they pierce the *rac* bones, and diuide the marrow of the backe, then all the parts vnder the wound will be paralyticall. If the wound be in the throat, it is a venture but the ingular veines, or the sleepey arteries, or both, may be diuided, and then the fluxe of blood must be carefully stayed,

stayed, for blood is the treasure of Nature. If the artery be wounded, the blood is thinner, and comes away leaping with a kinde of subsultation. If the veine, it is thicker and blacker, and comes away more slowly. If the wound be not deep, nor any notable vessell diuided, you may clap on a pledget with such a medicine. *Recipe Terra sigillat: boli armeni, ana dram. 2. thuris, mastiches, myrrha, aloes, ana dram. 1. farina volatilis molend 3 B. fiat pulvis qui albumine oui excipiat.* And then binde it vp. *Blondus* commends this, wherewith he saith, he hath stayed the blood of veines and arteries. *Recipe vitrioli Rom. sanguinis draconis, boli armeni, pilorum leporis, aruginis lebetis, aloes, thuris, tela Arachnes, & omnia commisce cum albugine oui.* If that will not doe the feat, take away all that couers from off the wound, and with your thumbe presse the wound and orifice of the vessell which is decayed, till the blood be clodded, and so much dried about it, that it will close vp the vent. If that will not serue, you must find out that orifice of the vessell which is next his originall, and with some part of the flesh, stitch it vp, and this way also will serue the turne when the ioynt is dismembred. But because when such a notable veine or artery is diuided, the orifices will be retracted, and shrinke vpward and downeward, the Chirurgian in that case shall diuide the skin till he finde the orifice, and then stitch it vp, and afterward binde it safe, and not remoue his Ligature till the flesh be growne to couer the orifice. If the condition and nature of the part will not admit of this operation, then he shall clap on a cautery, sometime actuall when the part will beare it, sometimes potentiall, as the poulder of *Vitriol* burnt, or a little quantity of Mercury, and burnt Alume in poulder, and the *Eschar* he shall not hasten away, but suffer Nature to shed it, and so there will be no danger. It may also happen, that if the vessell be not quite diuided by the wound, the Chirurgian shall be constrained to diuide it, that the ends thereof parting asunder, the flesh of the neighbour parts may stop the flux, being assisted by such helpes as are before spoken of. But this is the last refuge, and the Chirurgian shall not ascend vnto it, if he can otherwise chuse.

If the rough artery or the gullet be diuided, the expert Chirurgian shall artificially stitch vp the wound, and in the meane time nourish his Patient with brothes or gellies, but not suffer him to eate any thing which may extend the part in the swallowing: He shall also cause his Patient to vse such a gargle warme, which will supple the part, ease paine, giue him liberty of breathing, and beside, serueth to deterge, and agglutinate, or sawder the wound. *Recipe Hordei m. 1. florum rosarum pug. 1. passul. mundat. inubarum ana 3 B. glycyrr. 3 1. bulliant omnia simul, addendo, mellis rosat. & Iulep. rosat. ana 3 2. fiat Gargarisma.* One instance in *Paraus*, I will adde, because it happened to our owne Countreyman.

Two *Englishmen* for their pleasure walked to a wood, one of them was full of money, and beside had about him a gold chaine of good waight; his Companion suddenly set vpon him, stabbed him through the weazon and the gullet, and cast him aside among certaine Vines, rifled him and leauing him for dead, got into the City. The wounded man with much a doe, got into a Cottage neere hand, where hauing some small helpe to relecue his wounds, he was brought into the City, and committed to *Pareus* his care. Hee found the weazon quire cut a sunder, which he presently sewed; the gullet which was also diuided, he could not come to stitch, for it was fallen downe vpon the stomacke: that was his death, yet he liued to bewray the murderer, who also had his deserued punishment, being broken vpon the Wheele.

CHAP. XXII.

Of the wounds of the Chest.



Wounds of the Chest which are penetrant (for of those only I will speake) are distinguished by this, because if the Patient stop his nose & his mouth, the wind will breake forth at the wound, so as it will blow out a Candle set neere it. In this case it is controuerted whether the wound should be as suddenly healed vp as may be, or whether it should be kept open. If it be kept open, the danger is, that the cold ayre will enter and ouercoole the heart, and beside that the vitall spirits will finde way by the wound, and be expended. On the contrary if the wound bee closed, the blood which falleth vpon the wound into the capacity of the Chest, cannot get out, but there will putrifie, whence will proceed Feuers, the Fistula, and such like accidents. In so much as sometimes the Chyrurgian is constrained to enlarge the orifice of the wound for the better auoyding thereof. This question is easily asfoyled. For if there be

be no blood, or very little shed into that capacity, it is best to heale it vp as soone as you can. But if there be much, you must keepe it open till it bee gotten out. But how shall that be done? You must place your Patient vpon a bed, with his head and brest hanging ouer the side, with a footstoole to leane his Elbow on, to stay his body with; and then let him stop his Nose and his Mouth that his Longues may swell, and therewith the midriffe will rise, and so the blood will issue at the wound, especially if you cleere the orifice from clodded blood with your finger, or some fit Instrument. After some part is come away, lay him at ease vpon his bed, and deliuer at the wound with a large syring an injection, made of a decoction of Barley, *Mel Rosarum*, and browne Sugar; and hauing that in his body, let him wallow on both sides, as it were, to rinse his chest, and then lay him ouer his bed side, as before, to auoyd that which was cast in, with which the remainder of the blood will also issue. The next day iterate the injection, but make it more detergent, yet put in no very bitter things, for the bitterneffe will easily passe through the Longues into the mouth, and breed an intollerable distaste. Hasten your cleansing of the Chest as much as you can, that you may leaue Tenting of the wound, for it will soone grow Fistulous. And when in the beginning, you are constrained to tent it, take heed you make not your tents of Lint, least it be drawn by the brest into the Chest, but make it of fine old Cloath, and let a good part of it hang by, or be fastned to the boulder, that you may retract it at your pleasure; for if it fall in, it is certain death: yet I know *Fabritius* in his Century, makes mention of one who caught vp two Tents which got into the capacite of the Chest, about three monethes after they fell in. Now if the wound doe degenerate into a Fistula, which it will sometimes, doe the Chirurgian what he can, then is the mischiese doubled, for Fistulaes of the Chest are scarce euer cured, and that for many reasons. First, because the muscles of the Chest are in continuall motion; secondly, because the ribs hath no other inward couering but the *pleura*, which hath little blood in it. Thirdly, because the wound hath no flesh to rest against, so that the lips of it cannot be stitched or drawne together by a Ligature, that so it might heale.

But to returne to the Syring: You must carefully obserue how much of the injection you cast in, and looke you haue it all againe returned, for if any of it stay behinde, it will do mischief. After the injection is returned, you must provide a siluer or a leaden pipe, with two or three holes in the end of it, which you may put into the wound, if it be fistulous, that by those holes the *sanies* may issue; you shall make the outward end of it broad, and tye it fast with strings, that it get not into the capacity. The broad orifice of it you shall close with a soft Sponge and large, moystened with Wine and *Aqua vite*, and that warmed together: this Sponge will not onely keepe out the cold ayre, but will also receiue the sanious matter which issueth from the wound, and so much the rather if the Patient stay his breath often, as we haue before said, and tumble on each side, especially on that which is wounded. Neither must you forbear the vse of this pipe till the Fistula become dry, then may you



safely indeuour the Cicatrice, not before. The figures of such a Syring, with such pipes and Sponge as I before spake of, are here represented, sauing that the Cutter hath made too many holes in them.

Vpon the wounds of other particular parts I will not insist, because I intend not any general Treatise of Chirurgie, but onely of the vse of some of the Instruments, and therefore I will now proceed to those wounds which come of Gunshot, about which many instruments are of necessary vse.

CHAP.

CHAP. XXIII.

Concerning wounds made with Gunshot.

IT is a grand and maine disadvantage in all professions, to take precepts and practises vpon trust, without examination of the reasons, of how great authority soeuer the Author be. I will instance in this one operation of Chirurgery, concerning the cure of wounds made by Gunshot. *Vigo* a learned man, and one who hath deserued aboue many others, excellently of the Art of Chirurgery, who also flourished in the times that were neere to the inuention of that diuellish Engine, in the eight chapter of his first booke *De vulneribus*, wrote, that wounds made with Gunshot were poysoned with the Gunpowder, and therefore prescribes that they should be cured with the Oyle of *Sambucus*, which is an extreame hot medicine, yea, a very Causticke as he vsed it, for he commanded it should be mingled with a little *Theriac*, and powred scalding hot into the wound. This authority of *Vigos*, all Chirurgians followed in their practise. So did *Pareus* himselfe, then but a yong man, Anno 1536. when he attended the French Army, because he saw all the rest of the Chirurgians goe that way. It happned that in a hot skirmish so many men were wounded with Gunshot, that all his store of the oyle of *Sambucus* was spent, and many remained to be dressed, whom he was constrained also to dresse, and therefore made for them a Digestiue of whites of egges, oyle of Roses and Turpentine; but as he tels the tale, he was much troubled all the night following, imagining that those whom he had so dressed, he should finde in the morning, either dead, or a dying of their poysoned wounds, because he had not dressed them with the Causticke. Rising very early to visite his Patients, hee found that those whom he had dressed with the digestiue onely were in great ease, and had had a good night, and their wounds were without inflammation or swelling, but the rest who were dressed with the scalding oyle, had Feuers, grieuous paine, and their wounds were swelled, and the parts about them. When he had made experiment of these accidents in many others, he resolued at length to vse the Causticke no more, in which opinion, he was after confirmed by a Chirurgian of great note, who also taught him a soueraigne oyle wherewith he was wont safely to cure wounds made with Gunshot, the receit I haue hereunder set downe. *Recipe Caninos Catulos duos, vermium terrestrium libram unam, olei liliacei libras duas, terebinthina Veneta uncias sex, aqua vite, unciam unam. Catulos vinos in oleum illud coniectos coque quousque carnem ossa descerunt, mox vermes ante in vino albo suffocati, in eodem oleo feruefiant, quoad elixationis vehementia arefacti succum omnem suum in illo decocto remittant. Mox totum id manili transmitto non admodum arcta facta, expressione. Colatis succis terebinthinam adde & denique aquam vite.* Together with the receit, he charged him that he should not communicate it, when *Pareus* came backe to *Paris*, he went to visite *Siluius*, the Kings Professor of Physicke, and amongst their discourse, *Siluius* enquired whether he had learned in his iourney any new method of curing wounds made by Gunshot, and the combustion made in them by the Gunpowder. *Pareus* replied, that there was no venomous nature in the powder, for none of the Simples whereof it was made were poysonous, and beside that he had seene many souldiers take a great quantity of the powder in wine, because they were perswaded when they were wounded, the drinking of that powder freed them from many malignant symptomes. Which course, though he did not like, yet was it argument sufficient vnto him, that the powder was not poysonous. As also because it was obserued that the sprinkling of Gunpowder vpon rebellious Vlcers, bred no symptomes of poysons, but rather did good. As for the bullet, that it was impossible it should conceiue such a heat as should render it Causticall. For if a Bullet be shot against a stone wall, as soone as it falleth from the wall, you may take it vp in your hand without offence, yet a man would thinke it should rather bee healed with the resistance of the stone, then in a mans body. These and the like arguments produced by *Pareus*, *Siluius* perswaded him to write a Treatise of the cure of Gunshot, that the pernicious counsell of *Vigo*, which many men had taken from him vpon trust, and practised to the great detriment of their Patient, might at length receiue redargution. Whereupon *Pareus* applyed himselfe to that businesse, and beside, deuised many new Instruments, whereby Bullets and such like might be extracted out of mens bodies, which Instruments or the most necessary of them at the last, you shall finde deciphered in this following Discourse. But because *Pareus* to giue satisfaction to *Charles* the ninth, and diuers other Princes

Ol Catulorum
Parei.

Princes, hath to his Treatise of the Curing of thote kinde of wounds, præmised an elegant discourse, wherein the nature of such wounds is learnedly handled, I haue thought fit to insert it in this place, for the satisfaction of such as are desirous to heare reason, and are willing to be guided thereby.

*An Apologisme of Ambrose Pary, to Charles the ninth, concerning wounds
made by Gunshot.*

BEing required to render a reason, why the greater part by much, of such as are wounded by Gunshot, did die of their wounds, or at least with much adoe recovered at leasure, yea, though the wounds were not great, and the Chirurgians attended them with all their care, I am bold before my Treatise of the Cure of such wounds, to premise this discourse by way of Apology, as well to satisfie the desires of many Noble personages, as to answer the expectation which may be conceiued of the Kings Prime Chirurgian, which fauour being conferred by *Henry* the second, and confirmed vnto mee by *Charles* the ninth, the worthy sonne of so Noble a Father, I doubt not but many who put too much confidence in their owne iudgements, and doe not intend the narrow disquisition of the causes of things, will wonder and impute it to me for an argument of temerity, that I should stray so farre from the footsteps of learned men who haue gone before me, and strue to cancell their rules and directions; because my opinion is, that the ill qualities which are ordinarily seene in wounds made with Gunshot, doe not proceed from any poyson in the Gunpoulder, neither yet from impoysoning of the Bullet; But I hope that if as men of reason, they will diligently wey my arguments, they will either accord with me, or at least excuse me of presumption, because I intend the common good. But I doubt not to proue by firme reasons, drawne out of the doctrine of the Ancient Philosophers and Physicians, and beside by vncontroulable experiments, as well of my owne, as of other worthy Chirurgians, that the stubbornesse and ill disposition which we vsually finde to accompany these wounds, is not to be attributed to any poyson in the Gunpoulder, or the Bullet, neither yet to any combustion fastned by that poulder vpon the affected part. To begin therefore in order, I will first euict that such wounds are not poysoned, as well because there is in the poulder neither poysonous matter nor quality, or if there were, could they make any impression vpon the wounded part. To this end wee will first examine the composition of Gunpoulder, and see the particulars whereof it is made, their essence, powers, and qualities, and what effects they bring forth, for the simples being knowne, it will not be hard to determine of the nature of the composition. There are onely three simples in this composition; Charcoale made of Sallow, Willow, or Hempe-stalkes; Brimstone, and Salt-Peter. and now and then a little *aque vite*. If you take consideration of every one of these seuerally, you shall finde that they are all free from poyson, or any poysonous quality. The Coale hath nothing in it beside *siccitie* and *tenuity* of substance, from whence it as easily takes fire as Tinder. Brimstone is hot and dry, but not in the highest degree, of a *viscid* and oylie substance, and therefore though it take not fire so soone at the Coale, yet it retaines it better, nor is so soone extinguished. Salt-Peter is so free from poyson, that many men vse it ordinarily in stead of Salt; so that of all the simples in this composition which are with poysonous some suspect, the Sulpher or Brimstone most, though they haue the least reason so to doe. For *Diascorides* appoints Brimstone to be dranke or supped off in an Egge, for such as are troubled with the *Asthma*, with frequent coughings, which spit vp purulent matter out of their Longues, or are troubled with the yellow Jaundise. *Galen* vses it in them that are bitten with venemous Beasts, or are vexed with the Maunge, the dry Scab, or Ring worme, and the Leprosie. *Aqua vite* is of so fine and thin a substance, that if there be any of it in the Gunpoulder, it vanishes as soone as the fire is conceiued; or if it were not, every man knowes how harmelesse a thing it is, either to take inwardly, or to vse in frictions outwardly. It remaineth therefore, that seeing all the parts whereof Gunpoulder is compounded, are free from poyson, the poulder compounded of these parts should haue no poyson in it. And to this euidence of reason, experience also doth suffragate. For the *German* horsemen if they be wounded with Gunshot, doe not doubt to drinke an buncce of Gunpoulder dissolued in wine; and vpon the taking of it, doe promise to themselves immunity from those malignant symptomes, which vsually accompany those wounds.

I will

I will not dispute whether they doe well or no in doing so, but sure they finde no symptoms of poyson to follow, in so much that the *French* souldiers will take it often in a bravery when they haue no need, and that without detriment; yet it is very profitably sprinkled vpon most Vlcers to dry them; & it does the deed. Some there be who being conuinced by these arguments, confesse and acknowledge that the poysonous quality in wounds made by Gunshot, doth not proceed from the Gunpoulder, but from the Bullet which is poysoned. To this I answer, that if there be any such craft or wickednesse attempted, yet the fire dissipates all the force of the poyson, that none of it can remaine vpon the Bullet when it attaines to the marke. And this opinion of mine is confirmed by those things which happed in the siege of *Rouan*. For it is well knowne, that in the Kings Army there were no Bullets poysoned, and the Townesmen when they saw how mortall those wounds were, and immedicable were perswaded the Bullets were impoysoned. On the other side, the Kings Army esteemed all the Townesmens Bullets to be poysoned, because the Chirurgians could scarce cure any of them, they were so euill qualified. Both sides being deceived by assigning a cause according to their construction of the effect. Vnlesse you will vnderstand a pestilent or venemous wound, as *Hippocrates* sometimes vnderstands a pestilent disease, for he calls all diseases pestilent which take their originall from common causes, of what kind soeuer they be, especially if many die of them; because there is in them a malignity proceeding from those common causes, either in the ayre, or in the temper of the heauen, or in the dyet of the people, or the like. For it is to be granted, that wounds made with Gunshot are more obstinate and refractary in their cure, not that they haue any poyson in them, but by reason of some comon viciousnesse in the bodies of men, in the ayre, or disposition of the heauens, or in the corruption or putrifaction of the common viands, all or most of which are very ordinary in populous Armies. And these are the causes which usually make wounds of euill condition, and so obstinate against whole some and fit medicines. I conclude therefore that wounds of Gunshot are not poysoned.

The other question is, whether there be in them any combustion. And first, I know not how it can be conceiued, that Bullets which are made of common Lead, can conceiue so great heat, but that they should melt, whereas we see they passe through Armour, Body, and all, without any signe of liquefaction. Yea, they are so farre from liquefaction, that if they be shot against a stone, as soone as they fall you may take them vp in your hand, and perceiue no heate at all in them. Yet a man would thinke that the violence with which they strike against a stone, should somewhat increase the heat, if there were any. Againe, if there were any fire in the Bullet, being shot into a Barrell of Gunpoulder, it must needs set it on fire, which is against all experience: It may happen that the Bullet offending against iron or stone, may strike fire, and so set the whole Barrell on fire. The like reason there is when a Barne or thatcht house is set on fire by discharging Gunnes against them. For those cunning Incendiaries fasten to the Bullet some Touchwood, or other peece of dry trash, which conceiues fire in the discharge of the Peece, and carries among the Straw, which sets it on fire; or it may be browne Paper, or linnen, wherewith the charge of poulder is rammed downe, will carry fire with it to the house, if it be neere hand. There is also another thing which confirmeth me in this opinion. For if a man shoot a Bullet of Wax which cannot conceiue heat without melting against a boord of an inch thicke, that waxen Bullet will pierce through the boord. It remaineth therefore that the Bullet conceiueth no such heat, that it should burne the wound like a Cautery, either actuall or potentiall. It will be objected that the *Verges* or lippes of all such woundes are blacke, I confesse it, but that is the effect of the vehement contusion; and the contusion is very vehement, as well because the Bullet is round, as because the stroke is so impetuous, that nothing but sense could make a man beleue it. For he that is shot, thinkes presently some huge waight hath fallen vpon him, whence comes a grauatiue pain, & an astonishment in the part wounded, in so much that the naturall heat and spirits are so much dissipated, that the part often Gangrenates. And whereas they say that an *Eschar* falls vpon such woundes; they are deceived, for they mistake for an *Eschar* small portions of membranes, and flesh brused and torne from the rest, which putrifying, are separated by the vigour of Nature, as in all other kindes of vehement contusions we apparantly see.

Notwithstanding these manifold reasons and euidence of sense it selfe doe conuince that there is neither poyson in Gunpoulder, nor combustion from the Bullet, yet there are some which seeme to themselves, at least would seem to others to haue arguments against this truth built vpon naturall principles.

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The report of the Canon (say they) is like the lightning and thunder which breaketh out of the cloudes in the middle Region of the ayre, and are precipitated vpon our world, and therefore the Bullet must needs as the thunderbolt, be poysonous and causticall. I am not ignorant that the lightning which is ingendred of a crasse and viscous exhalation, when the cloud wherein it inuolued is broken in sunder, neuer falls vpon the earth, but it carries fire with it, sometime more subtile, sometimes more crasse and materiall, according to the differing condition of the matter from whence the exhalation did proceed. For *Seneca* Quest. Nat. lib. 2. ca. 49. writes, that there are three sorts of Lightnings which differ one from another in the inflammation, in the kinde, and in the plenty. The first is, that which by reason of subtilty and thinnesse of his matter, penetrates that which withstands it; as it were, by perforation. The second is, that which with impetuous violence disheuers and dissipates whatsoeuer it meets with, because the matter of that fire is more dense and compact, and his course more rapid, furious, and contorted. The third is made of a more earthy matter, and burnes where it touches, and leaues behinde it footsteps of his adustion. I know also that all Lightnings is of a pestilent nature, and the two last kinds foetid also, because of the viscous crassament, which being set on fire, exhales an odious odour, wherewith the very wilde Beasts are so offended, that if it fall neere their dennes, they will forsake them. And *Olaus Magnus* in his Northerne History, saith, that they runne farre and wide after a Lightning is strewed with Brimstone, but doted and extinct, which otherwise is a quicke and *viuid* Minerall. But it doth not follow hereupon that the shot of a Canon or Musket transferres poyson, or fire into the wound it makes. For though the Canon and the Lightning be in many things alike, yet the likenesse holds not in the matter and substance, but onely in the impressions they make vpon the bodies which oppose them, those they equally rend and tear, dissipate and demolish; the Lightning by the violence of fire, and sometimes by the thunderbolt; but the Canon by the rapid agitation of the Ayre, whereby the Bullet is furiously transported. Or if it should be granted that the matter of them both is alike, yet it would not follow that the Bullet should conceiue or retaine any fire. For according to *Pliny*, there are some Lightnings which being composed of a matter exceeding dry, do indeed shatter all things that oppose them, but burne not at all. Others which being of a moyster Nature, do soyle & make blacke, but burne no more then the former. Finally, there are other Lightnings of thin and subtile Nature, which kinde *Seneca* esteemes to be Diuine, because they will melt money in a mans purse, but the purse they will not burne, in like manner they will melt a sword in the Scabbard, but not offend the Scabbard at all with any appearance of combustion; All these kinds of Lightnings a man may imagine to be of like substance with the stroke of a Canon. But not those which carry fire and flame on their wings. To exemplifie this truth. I remember I once drew out of a Souldiers thigh, a Bullet which was rolled vp in a peece of his Cannions, the cloath was of a fine wool, yet sound and not at all scorched. Againe, I haue knowne many whom the Bullet nor the Poulder euer toucht, but flying neere their heads, hath stricken them downe in an astonishment; yea, some whose flesh hath presently growne liuid and blackish, vpon which hath followed a Gangreane, whereof they haue perished. These and the like accidents to these, doe neereley resemble the effects of those Lightnings whereof I spake euen now, and yet are without shew of poyson. I conclude therefore that the stroke of Gunshot doth neither impoyson nor burne the part. But because in these last Warres, the wounds of Gunshot proued so refractary and mortall, as well to those of the Nobility, who had as much meanes as could be imagined, vsed for their recovery, as to the common souldiers: It is necessary I should vnfold the true causes of that contumacy and mischief, seeing I disauow the causes which were commonly receiued, to wit, poyson and combustion. For the better explication whereof, I must take my beginning from the mysteries of Nature, and the principles of Philosophy.

It is therefore confessed on all hands, that there is a sympathie of the foure Elements, whereby they are so disposed, that they easily suffer transmutation one into another: A transmutation, I say, not onely by a vicissitude of the first qualities, that is, of heat and cold, drought and moysture, but by rarefaction and condensation their proper substances are commuted, so that fire is turned into ayre, ayre into water, and water into ayre, waer also into earth; and contrariwise earth into water, water into ayre, and ayre into fire; the reason is, because those first bodies, being made of a common matter, are furnished with contrary qualities, which being the first qualities, are also most potent and efficacious in their kinds. An example of this we haue in the *German Scelopylis*: An instrument made of
brasse,

brasse, hollow and writhen, and determining in a narrow point, into which when water is conveyed, and that point held neere the fire, the heate thereof rarifies the water into fyre, which because of the contorsions, finding not a free gresse breakes out with murmour and noyse. The very same thing you may obserue in parching of Cheasnuts, put them whole into the fire, and suddenly they will cleaue with a great cracke, the reason is, because the waterish moysture contained in them, is by the heate and actiuity of the fire, rarified into ayre which breakes a way for it selfe. For water being so rarified into ayre, occupieth a greater place then it did whilst it was water, and therefore cannot be contained with the skinnes of the Cheasnut as it was before, but forces a passage for his liberty. After the very same manner Gunpowder being set on fire, extends it selfe into a farre greater proportion of ayre, and some limit the proportion thus. One part of earth makes ten such parts of water, one part of water makes ten of ayre, and one of ayre ten of fire. Wherefore that ayre when it cannot be contained in the barrell of the Peece wherein the Powder was contained, makes way for it selfe with impetuous violence, and driues the Bullet before it, and giues the report; yet so as that it instantly vanishes into the ayre adjacent, so farre is it from attaining to the marke at which the Bullet arriues. Notwithstanding we say that the Bullet it selfe doth so inforce the ayre it meetes withall, especially if it be the Bullet of a Peece of Ordnance, that that very ayre so vehemently in force, will breake a mans bones without breaking the flesh, and therein it is like the Lightning as I said before.

Another experience hereof we haue in Mines, wherein Gunpowder being set on fire and turned into ayre, will blow vp a little mountaine of earth. In the yeare 1562. a proportion (not very great) of Gunpowder, conceiuing fire in a Magazine, made such a thunder as shaked the whole Citie, but the houses which were neere it ouerthrew to the ground, those that were further off it dismantled, broke all the windowes, and like Lightning in a Storme, some mens breath it strooke out of their bodies, some lost their eyes, some their hearing, some mens members were torne off, as if they had been rent with wilde horses; and all this onely by the agitation of the ayre, into which the Gunpowder being set on fire, was conuerted. Like as we see when wind is concluded in the bowels of the earth, which want vent for it, it rages about the conceptacle, and shakes the sides of the earth, and produces an earthquake. And many times it heaues it vp, or sinkes it downe, or which is most strange, transports it to another place. So we reade, that *Megara* and *Agina*, sometimes famous Cities of *Greece* were demolished and swallowed by an Earthquake. These things being premised, wee come now to accomodate them to our present purpose. Among those things which are necessary for the life of man, there is nothing which makes so many alterations or so great, as the aire, which we continually draw into our bowels, as well by inspiration, as by transpiration, whether we wake or sleepe, whether we labour or be at rest. Whereupon *Hippocrates* giueth it the title of Diuine, for it imbraces, nourishes, defends, and tyeth, as it were, in a band of concord and agreement, whatsoever is contained in this lower world, wherethrough it breathes. Moreouer, it also consents and agrees friendly with the influences of the starres who are partakers of Diuine virtue and efficacie. For these influences making alteration in the ayre, doe thereby impress a necessary mutation vpon the inferiour world. Hence it is, that Physitians and Philosophers when they would giue precepts, either for the maintayning of mens health, or the profligating of diseases, doe command vs religiously to obserue the sites and dispositions of places, and the constitutions of the ayre. And that the ayre hath a great command ouer the world, appeareth by the foure seasons of the yeare. For in the Summer, the ayre being hot and dry, doth likewise heate and dry mens bodies: in like manner, the cold and moyst Winter, makes the body coole and moyst, and brings forth consimular effects, yet with that temper, proportion and moderation, that the variety is within the limits of health, if the seasons keepe their seasonableness; but if they depart therefrom, that is to say, if euery season doe not answer the lawes which Nature hath imposed vpon it, but trench vpon the temperatures of other seasons, then arise many and potent perturbations, not onely in the bodies, but in the mindes of men also, and the impressions of that obliquity and preuarcation it is not possible to auoyde, because the cause is ambient and entred together with the ayre into the secretest corners of bodies, as well by the blinde pores of the skinnes, as by the open and direct in-draughtes. Particularly for the winds, the South-wind is hot and moist, the North, cold and dry, the East-wind is briske and cleare, the West contrary, turbulent and nubulous. Can any man then imagine but when the winds so seuerally qualified, doe

raigne,

raigne and domineere in the ayre, which we continually inspire and expire, but that it is of necessity that those mutations should affect our inward parts? Hence it is, that *Hippocrates* obserued that the commutations of seasons, whether they proceed from the winds, or from vnseasonable vicissitudes, are the especiall authors of diseases. For example. A Northern constitution of the ayre, firmes and fastens the body, makes it agile and nimble, giues it a fresh colour, and quickens the hearing. All this it performes by rowzing and vegetating the naturall heate. On the contrary, the Southerne constitution dissolues the powers of the body, and moystens the whole frame, duls the head, amazes the hearing, makes men giddy, and turne-sicke; listles also, and heavy-ey'd, all which inconueniencies the *French* of *Languedocke* are too sensible of, and yet they are seated amongst the most deliuer and active of the *French* Nation. In summe, if you compare the seasons and constitutions one with another, you may conclude, that generally the dryest are most wholesome and lesse dangerous; to wit, because too much moysture is the mother of putrifaction, as may be perceiued by those that liue vpon the Sea-coast, for the winde which comes from Sea, makes those Vlcers which would easily be cured, become more stubborne, by reason of the multitude of *Sordes* which they gather. Beside, the flesh that is there killed for mans vse, will putrifie in an howre. I thinke a better reason may be giuen hereof: As therefore when the seasons of the yeare are seasonable, according to the vicissitudes of the Law of Nature, either there will be no popular diseases at all, or else they will be lesse dangerous: So if they be not correspondent, but distempered and peruered, the Symmetry of mens bodies is dissolued, and sicknesses either rush or steale vpon them. Whereas therefore, for diuers yeares now past, the foure seuerall seasons of the yeare haue been vnseasonable, the Summer wanting his heate, and the Winter his cold, and the Southwinds so frequent, that all things haue abounded with superfluous moysture, whereby the strength of Nature hath languished, and beene dissolued, I beleue that any man skilfull in the course of Nature, and the affections of the Heauens, will easily referre the malice and contumacy of these diseases wherewith *France* hath been a long time trauailed vnto these inordinate dispositions of the Ayre and the Heauens; From whence trow-we-else could so many pestilent and contagious diseases proceed, wherewith all Ages, Sexes, & conditions of men haue bin afflicted? Whence came the popular Murres and Poses, the Hoarsenesse, Pleuresies, Tumors, small Pockes and Meazels: Itchings also and Breakings out, which no Medicine could concoct and mitigate? Adde hereto many sorts of venomous creatures, Toades, and Frogges, Grasshoppers, Wood-seare-wormes, Spiders, Gnats, Waspes, Hornets, Beetles, Dew-Snailes, Vipers, Snakes, Lizards, Scorpions, and the like; All which are bred out of Putrifaction, putrified and actuated by an euill disposition of the superior bodies. Hence also came the weakning of mens naturall heate, whereof their spirits and humours being destitute, did runne into corruption, which also was increased by many foultry Southwinds. And therefore the blood that I haue let by the appointment of Physicians, in these yeares by-past, hath had for the most part a Character in it of putrifaction, to wit, a liuid or greenish colour, and that not onely in such as haue beene sicke, but in those also which haue beene let blood for preuention of sickness. If therefore the blood and humours were so corrupted, it must needs follow, that the flesh which is made and amassed of them, must needs be vicious, as well in temperature, as in the consistence. And hence in deed, and from hence onely it was, that the wounds wherein some part of the flesh was taken away, did hardly re-vnite, or not at all, because that should haue restored it, was ill-disposed. So we see that such as haue the Dropsie, whose blood is cold and waterish, and such as are leperous, whose blood is corrupted, if they happen to haue any Wound or Vicer, *Vix autne vix quidam curantur*, as *Hippocrates* saith. Yea, if a body be any way Cathetickall, or of ill-habit, the Wounds and Vlcers of such Bodies are hardly cured. And not onely so, but if any part of the body hath lost his naturall temper, and receiue a wound, that wound wil be very hard to cure. But if all these potent causes conspire together, that is to say, the indisposition of the aire, the putrifaction of the humours, and the distemper of the parts, what wonder is it, if the wounds which were not great, even in fleshy parts, in these last ciuill warres, proued dangerous and full of euill accidents; yea, many times mortall? I my selfe can witnesse, that in the cure of those Wounds, there arose from them such a stench (the most certaine signe of Putrifaction) that the standers by could vneath endure it. Neither could this stench be attributed to the fault of the Chirurgian, or to any want of good meanes in the progresse of the Cure, for the stench was all one in the wounds of the greatest Com-

manders, and of the poorest Souldiers. Yea, the corruption was so great, that if a wound did escape dressing but one day, (as in such a multitude it might well happen) the next day it would be full of wormes. Moreouer, (which doth further proue the height of the humours putrifaction) it was often seene, that Apostemations would arise in the parts opposite to those that were wounded, for example, if the right Shoulder-blade were wounded, the left Knee would apostemate, and the left Arme if the right Legge were wounded; which very thing hapned to the King of *Nanarre*, the Duke *Neuers*, and the Lord of *Rendan*, and many others. In a word, All mens Natures were then so surcharged with the burthen of vicious humours, that it was necessary some part of them should either bee amanded into the habite of the body, and there Apostemate, or bee otherwise thrust into the more noble parts: for in those bodies which were dissected after death, a man should finde sometimes the liuer, sometimes the spleene, sometime the longues, sometime other of the bowels purulent. From these Lee-stals the vapours being eleuated to the heart, bred continuall feuers, and because the liuer and all the yeines were so defiled that they neither could breed nor did containe laudable blood, the body grew into an *Atrophie*; the braine was drawne into consent by the vapours which arose vnto it, and thence came phrensies and convulsions. If therefore the cure of wounds in such bodies proved vnprosperous, it was not to be imputed to the Chirurgian, but to be ascribed to Almighty God, and vnder him to the ayre, in which his scourges were disposed. I conclude therefore according to *Hippocrates* his opinion, that all wounds with contusion must be brought to suppuration, or else they cannot be cured; which course, if we held in wounds made by Gunshot, who can iustly accuse vs, though the successe did not answer our expectation by reason of the frequent Putrifactions, Gangrenes, and mortifications which hapned through the fault of the ayre. Yet did we not fight onely with that weapon of suppuration, but with diuers other medicaments and instruments to abate and ease those symptoms which threatned the liues of our Patients, of which we will intreat more particularly in the following discourse.

CHAP. XXIII.

The diuision and signes of Gunshot wounds.

THe wounds made with Gunshot are either more simple or more compound; We call those more simple which haue fewest symptoms, those more compound, wherein there is greater contusion, laceration, distemper or Tumor. If the Bullet light in a fleshy part, and therein determine, and no notable vessell be broken, the wound is more simple and will be cured wellnigh as easily as a wound made with any other weapon that wounds with contusion, for contusion lesse or more is common to all wounds of Gunshot. But if the contusion be notable, the laceration great, if any bone be broken, if any notable vessell be violated; finally, if there be any great distemper or tumor succeeding the wound, then is the wound more compound, and the cure of such symptoms doth many times diuert the Chirurgian from his course of suppuration, till he haue provided for that which vrages him more. Again, sometimes the wound is but superficially or descends not deepe, sometimes it penetrates farre, sometimes it goes through and through the body, and according to those varieties the cure is more easie or difficult. Moreouer, there is great difference in Bullets, some are great, some little, some betweene both: some are, as we call them, but Haile shot; allos them round. According to these differences the Chirurgian must fashion himselfe and vary his medicaments. Alwayes remembring that which I haue said before, that he impute not the many symptoms which follow this kind of wound to any poyson, or combustion, but to the vehemence of the contusion, laceration, or fracture made by the impetuous force of the Bullet.

For the signes, there is one generall, that the wound is orbicular or round: the Colour also of the part is altered and become liuid, blewish, greenish, or betwixt both. Adde hereto that the sense of the blow is grauatiue, as if some huge weight had fallen vpon the part: neither doth the blood issue proportionably to the wound, for the parts being sore brused, doe presently swell, in so much that you can hardly insinuate a pledget into it, for the lips of the wound being tumified, hinder the issue of the blood. There is also in this kinde of wound, a very great heate, caused either by the swiftnesse of the motion, or by the vehement impulsion of the ayre, or else because the contused parts being driuen one against another, raise heate by attrition. The reason why a Bullet makes so great a contusion, is, because

because it hath no corners to cut his entrance but is round, and therefore cannot enter without extreame force, and thence it is that not the wound onely is blackish, but the neighbour parts also are liuid. Hence also proceed those many ill symptomes of paine, fluxion of humours, inflammation, apostemation, convulsion, phrensie, palsie, Gangrene, mortification, and at length death it selfe. The contusion also and the rending attrition and tearing of the adjacent parts, make the sanies or matter of the wound which it belcheth out, to be of a noysome and odious saour, and so much more plentifull, because to a part so notably offended many humours will flow out of the whole body, which at the part affected cannot be gouerned by the weakned naturall heate thereof, and therefore rot in corrupcion. But if you adde to this confluence of humours, whereby naturall heate is suffocated, those other vniuersall or particular causes of putrifaction in the ayre, and in diseased bodies, then wil the matter or sanies be as neere a poyson as putrifaction can attaine being exalted, and consequently the stench and other symptomes more dangerous and mortall. Now I proceed to the Cure.

CHAP. XXV.

what must first be done in the cure of wounds by Gunshot.



Soone as a Chirurgian is called, he must first of all enlarge the wound (if the condition of the part will suffer him) as well that the sanies or matter may more freely issue, as also that he may more easily get out any thing which was thrust in with the Bullet (as ragges, towe, Paper, peeces of Harnesse, and the like) or the Bullet it selfe, broken splinters of bones, or brused flesh, all which with as much expedition as may be, must be drawne away, for in the beginning the paine and inflammation is not so great as it will be afterwards. For the better performance hereof, the Patient must be put into the same posture wherein he was when he received the wound, otherwise the conuersion of the muscles wil either wholly interclude and shut vp the passage by which the Bullet entered, or at least make it much narrower.

Now those strange substances of what kinde soeuer they be, which are contained in the wound, must be sought for, if it may be with the finger, for that is a more certaine search then with the Instrument: yet if the Bullet goe deepe, the Instrument must be vsed, to wit, a probe round, and obtuse, yea, a little butned at the end, that it may enter without paine; with such an one the Chirurgian shall try if he can finde the place where the Bullet is couched: yet hath it beene often seene, that what the Instrument could not finde, the finger hath discovered, obseruation being therewithall made, where the paine, where the hardnesse, where the Tumor, and finally where the flesh was liuid and discoloured.

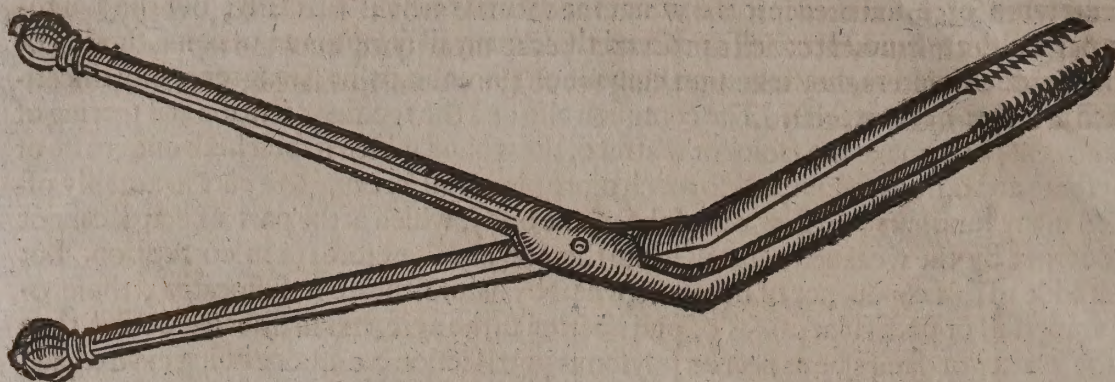
The den of the Bullet being found, the next care is how to get it out: That must be done by an Instrument made for the purpose. Of these instruments there are diuers formes in vse amongst Chirurgians, all which must be at hand to answer the variety of the Bullet, or the part wherein it is lodged. For a Chirurgian must fit his instruments to the part, and to the wound; he must not fit the wound to his Instruments.

These instruments framed to draw out bullets or other strange substances out of wounds made by Gunshot, are almost all called by one generall name, *Bills* or *Beakes*, as the Crowes Bill, the Cranes Bill, the Drakes Bill, the Parrots Bill, and the Swans Bill. One other there is made like the head of a Snake, and another headed like a paire of Moulds, wherein Pistoll Bullets are cast. The descriptions of them all you haue hereunder exprest with their particular names, that the Chirurgian may make his choyce according as the present occasion shall admonish him.

The toothed Crowes Bill.

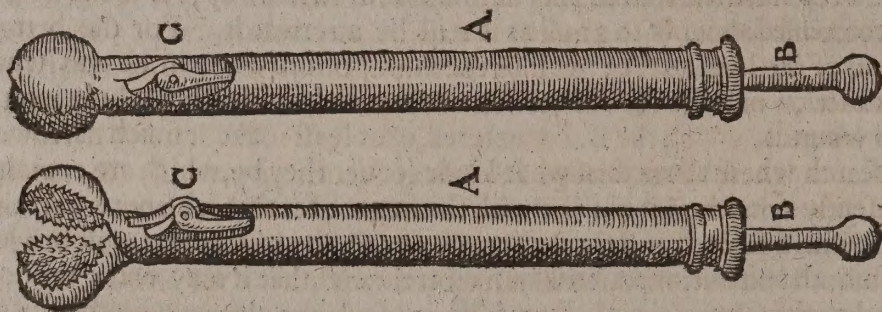


The crooked Cranes Bill with the teeth like a Saw, you shall finde described in the next Page following.

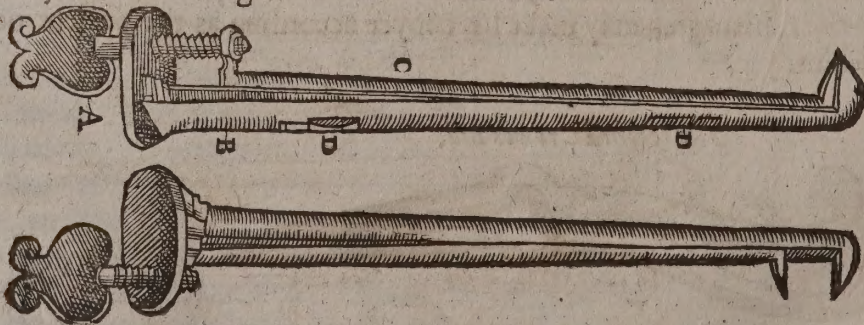


There is also a Cranes Bill which is straight, whose inside is rather rough and vnequall, like a Smithes File, then toothed or indented like a Saw, and that is fittest to draw out Haile-shot, small Plates, sharpe splinters of bones and such like, which are deepe in the flesh. And if these things require an instrument which will hold somewhat faster, then the Chirurgians may vse one somewhat broader and more vnequall in the insides and a little hollowed which is very properly called the Drakes Bill, to which it is very like. These two instruments need not be disciphered, for any man may easely imagine how they should be made.

If the bullet be rounder and larger, then the Moulds are to be vsed, made after this manner.



The head must be like the head of a paire of moulds, the body must be round and hollow, and is in the figure marked with *A*. Through that hollow body runnes a probe of iron marked with *B*, with a vice at the top like the vice of a pompe marked with *C*, which drawes vp the bucket; therefore with a pin is fastned one side of the mould head which is moueable, so that when the probe is thrust vpward the head of the mould opens, when it is drawne downe the mould closes and holds fast the bullet till all be drawne out of the wound together. The instrument called the snakes head is made after the same manner, sauing that the head of the Mould is round and the snakes head is flat and depressed, and therefore it need not here be delineated, the vse of it is when the bullet is flatted a little and hath lost his compasse. Somewhat different is the instrument called the Parrots Bill, and serues best to draw out any small peeces of Armour, Mayle, or whatsoever else the violence of the shot shall breake off and carry before it into the flesh or the bones: and therefore you haue the figure of it here exhibited.



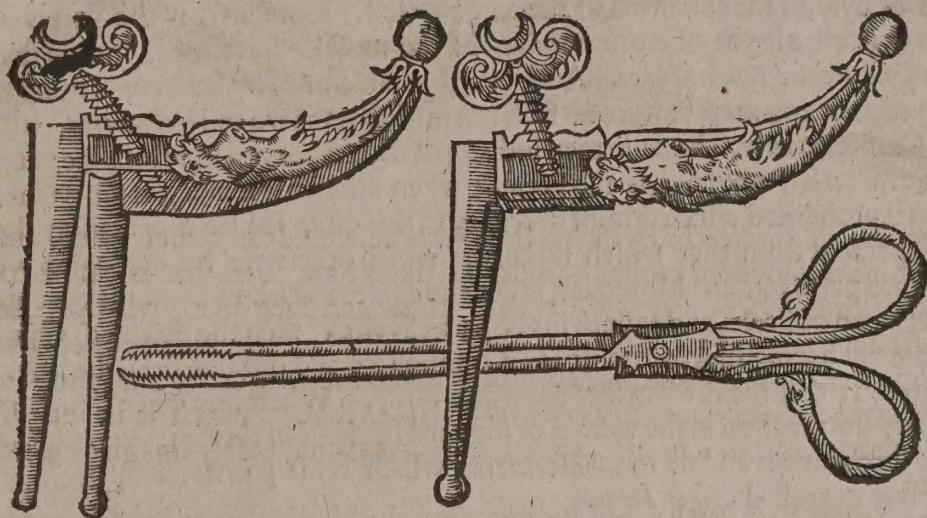
A, Sheweth the handle of the vter screw:

B, the trench or hollow screw in which the vter screw is inserted, to which it is fitted, & wher-

in it is turned. *C*, The moueable shaft or spindle which the vter screw eleuateth and sinketh. *D D*, a double part in the immoueable hollow trunke, which hath a Beake like a Parrot at the end, whence the instrument hath his name, and this hollow trunke and the parts therein, doe gouerne the motion of the shaft or the spindle.

There

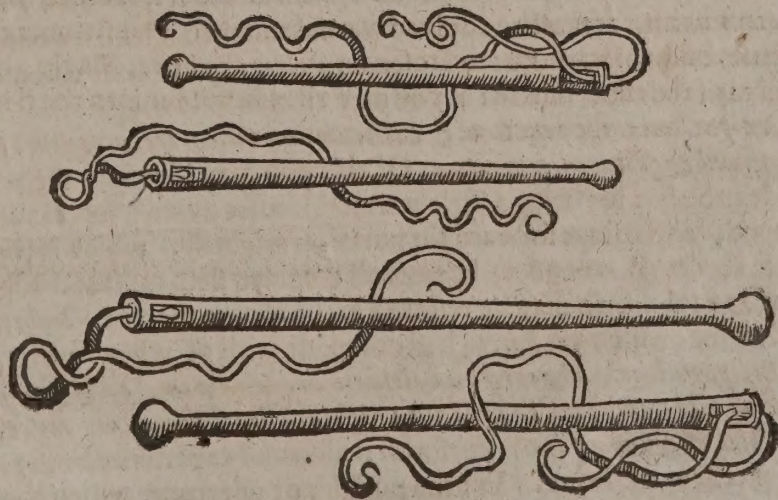
There is also another Instrument called the Swans beake, the sides whereof are opened by a screw when it is insinuated into the wound and so the wound is dilated; then they haue another slender instrument called the Cranes beake mentioned euen now, with which as with a payre of pincers, they take any thing out of the wound so dilated: the figures of both which are here vnder expressed.



But if those strange bodies which are driuen in, whether it be one bullet or hayle-shot, do not descend deepe into the wound, they may be gotten out with a small peircer serued at the end, and compassed about with a hollow cane of iron; which sharpe screw shalbe turned till it get hold of the lead, and so it may be drawne out. And thus much shall serue concerning the extraction of bullets, bones, peeces of iron, and other strange substances which are driuen into wounds.

Now to search where those strange substances lye in the wound (for the lippes of the wound presently vpon the stroake will close together) the Chirurgians vse a Probe, round and smooth, with a smooth button at the end, and so long that it may reach to the bottom; for being smooth and buttoned, it will not violate the flesh in the search. The same Probe also they make with a needles eye, that if the wound bee through and through they may draw a seton or a flamula through it, which they annoynt with medicines fit for their purpose: or if the wound bee not altogether but neere through and through, so that the bullet cannot bee drawne out where it went in, then the button of the needle serues to discover what distance there is of flesh betweene the bottom of the wound and the contrary side, and if it be not much, they make incision, and so take out the bullet; and when that is done, they draw a seton or flamula through to facilitate the cure. So that this Instrument serues for a double, yea a trible vse, and therefore you haue the description of it here vnder expressed.

And so much for
the finding & draw-
ing out of the bul-
lets.



CHAP. XXVI.

Of the first dressing after the Bullet is drawne forth.



When the Bullet or whatsoeuer strange substance is thus extracted, the next part of the cure is to minde the contusion by suppurations, such as is the oyle of whelps, vnlesse there be feare of a gangrene, either because of the constitution of the ayre, or the condition of the part affected. Moreouer, if the part wounded be neruous or neere a ioynt where the tendons of the muscles are fastned, then in stead of oyle you shall vse *Venice Terebintine*. Adde also that which *Ioubert* hath concerning wounds of this nature, that you must beware of such hot medicines as we call *escharotica*, (though they be not *Cauticks*) as well because they induce payne, inflammation, feuers, the gangrene and other like mortall symptomes, as also because when an eschar is made in the wound, all sup-
puration is prohibited which is most necessary in this case, for by suppuration the contused flesh is separated from that which is sound, which otherwise by contagion will bee also drawne into putrifaction. Moreouer, when the excrementitious humor is concluded by the eschar as by an obstacle, and resteth in the part affected, then the putrified vapours arising therefrom not hauing issue, are multiplied, transmitted, and diffused from the lesser vessels into the greater, and from them into the whole body. Wherefore when you haue reason to suspect any putrifaction in the wound or forward inclination thereto, you shall doe well to forbear suppurations and fly to medicaments which resist putrifaction, such as is the vn-
guent following called *Egyptiacum*.

R. Pulueris Aluminis Roche, viridis aris, vitrioli Romani, Mellis rosati, ana uncias duas; aceti optimi quantum sufficit, bulliant omnia simul secundum artem & fiat medicamentum ad formam mellis. The heate and subtile substance of this medicine affordeth it a facultie to cut and attenuate humors. It also recalls and establishes the naturall heate of the part which was afflicted and dissipated by the rapid and violent impulsio[n] of the bullet into the body; and besides it corrects the virulencie and contagion of the humor transported by the Contusion so far beyond his nature that it draweth neere the nature of poyson it selfe.

You shall therefore vse this medicine dissolved in vinegar or in *aqua vita*, and therewith annoynt your tent or the seton in the Chapter before spoken of, or the flamula. And at the first dressing you shall make your tents longer and thicker; longer, that they may attayne to the depth of the wound; thicker, that the wound being thereby dilated, way may be made for other medicines as cause shall require. But if the tent make not way sufficient, you may with a small syringe cast in what you thinke fit: yea this medicine it selfe being so dissolved, may be squirted in that it may search the bottome of the wound; obserue onely that in neruous parts you contemper this medicine with an admixtion of the oyles of *Terebintine* and *Hypericon*. But if there be no suspicion of putrifaction, nor the ayre be inclined to a pestilent Constellation, you may forbear this medicine, & in stead of it apply remollient and lenient, such as is the oyle of whelps before mentioned, which is thus confected.

R. Olei violacei libras quatuor, in quibus coquantur Catelli duo nuper nati vsq[ue] ad dissolutionem ossium, addendo vermium terrestrium vt decet preparatorum libram vnā. Coquantur simul lento igne, deinde fiat expressio ad usum addendo terebintina Veneta uncias tres, aqua vita vnciam vnā. It must be applyed warme, and then it hath a wonderfull vertue to ease paine, to hasten suppuration, and to loosen an eschar: but because this medicine cannot alwayes or easily be gotten, in stead of it you may vse this following.

Recipe Oleorum semin. Lini & Liliorum ana uncias tres, vnguenti Basilici vnciam vnā: liquefiant simul & fiat medicamentum. Of this you may issue into the wound as much as you shall finde to be fit: for being a little warmed, it eases paine, it supples and moystens the lips of the wound, and brings forward suppuration mightily, which is the mayne intention of all in these kindes of woundes, because all contused flesh must and ought to be suppured, that new and solid flesh may be restored in the roome thereof. *Ioubert* commends the medicine following, which yet *Pareus* had not made triall of when he wrote this Treatise of Gunshot.

Recipe Pulueris Mercurij bis Calcinati vnciam vnā, adipis porci recentis vel butyri recentis uncias octo, Camphora in aqua vita dissoluta drachmas duas, misce omnia simul addendo tantillum olei liliorum aut lini. Forsooth reason and experience both taught *Ioubert*, that this was an excellent medicine. For the poulder of Mercury, when it is mixed with a crasse and moyst matter, will in a short time turne Contused flesh into quittance, and yet procure no great payne. As for the Camphire, it is of exceeding subtile parts, and therefore doth not on-
ly

ly it selfe penetrate but is also a vehicle to transport other medicaments that they may more freely operate according to their virtues. Adde hereto that Camphire doth mightily resist corruption and putrifaction.

Now if the wound be giuen at hand and neere a man, it cannot be but it must be scorched because of the flame of the Gunpowder, and therefore in such a case the Chyrurgian shall vse such medicaments as are fit for that kinde of affect, and yet not neglect suppurations. As for those parts which touch the wounded part or are neere neighbours to it, I would not aduise that refrigerant and adstringent medicines should be vsed to them, vnlesse haply in the first dressing, for those that coole weaken the part and hinder suppuration; those that are adstringent doe constipate or close vp the pores of the skin, which is the cause that (the putrid vapours being concluded so that they can neither issue nor expire) the part Gangrenates and morrifies.

Moreouer, if the Contusion be notable so that much flesh about the wound is brused, then it wilbe fit to scarifie it manifold and deepe, that the part may be vnburthened of that brused and clodded blood, which if it subsist will easily degenerate into putrifaction. As for the parts which are farther remote from the wound and doe compasse the Contused flesh; it shalbe behoofe full to apply to them refrigerant and corroborating medicines which may stay and inhibit the defluxion of humours vnto them, such as is that which followes.

Recipe Puluer. Boli Armen. sangui. Dracon. pul. Myrrha, ana unciam vnam succorum solani, semperuini, portulacae, ana unciam vnam semis. Albumina quatuor onorum, oxymorodani quantum sufficit, fiat linimentum vt decet. This and such like you may vse till the feare of accidents or symptomes is ouer blowne.

Finally, there is no lesse care to bee had of the fitt binding of such wounds then there is of the medicines. Aboue all labour to place them in an indolent situation, dresse them not aboue once in 24 houres at the first, til the quittance begin to issue, afterward dresse twice a day that is once in 12 howres. but when the quittance flows abundantly so that it is troublesome to the patient, dresse every 8 houres: againe when the quittance begins to faile dresse every 12 houres, when the vlcer beginnes to fill with flesh once in 24 houres as at the beginning, and thus much of the first dressing.

CHAP. XXVII.

Of the second dressing.

IN the second and subsequent dressings (vnlesse there be a suspicion of putrifaction, or that the wound should Gangrenate (the cure whereof wee shall intreate of afterward) you shall poure into the wound onely some of the aforesaid oyles, adding thereto the yolkes of egges and a moment of saffron, and that so long till the excrement of the wound be concocted into quittance, which will be longer then is vsuall in other kinds of wounds not made with Gunshot, because not the bullet onely but also the ayre which the bullet impetuously driues before it, by braying the flesh as it were dissipates the natural heate and exhausts the spirits of the affected part, so that nature cannot hasten her worke of concoction; besides the stench of the sanies and other dry symptomes which follow vpon the Contusion breake her powers and interturbe her operation. Notwithstanding oftentimes about the third or fourth day, quittance will appeare sooner or later according to the complexion and constitution of the body, and the condition of the ayre: Thence forward you shall vse deterfues adding to your former medicament some Turpentine washed in rose water or barley water to abate his biting quality. If the season be very cold you may do it with aqua vita, or adde a little of it to the other. Your detergent medicine make after this manner. *Recipe aqua decoctionis hordei quantum sufficit, succorum plantaginis, apij, agrimonie, Centaurij minoris, ana unciam vnam; bulliant omnia simul; in fine decoctionis adde Terebinthine Venetae uncias tres, mellis rosati uncias duas, farina hordei drachmas tres, Croci scrupulum vnum: misceantur omnia simul bene agitando, fiat mundificativum mediocris consistentie.* Or, *Recipe Succorum Clymeni, plantaginis, Absynthij, apij, ana uncias duas. Terebinthine Venetae uncias quatuor, syr. absynthij & mellis rosati, ana uncias duas; bulliant omnia secundum artem, postea colentur, Colatura adde puluer. Aloes, mastich, Ireos florent. farina hordei: ana drachmam vnam: fiat mundificativum ad vsum dictum.* Or, *Recipe Terebinth. Venetae lota in aqua rosarum uncias quinq, olei rosati, unciam vnam, mellis rosati uncias tres, myrrha, aloes, mastich, Aristoloch. rotunda. ana drachmam vnam semis, farina hordei drachmas tres: misce, fiat mundificativum.* Which medi-

medicines you shall vse with tents neither too long nor too thicke, least the tent hinder the issue of such vapours as are rayfed in the wound. For if those vapours be intercluded, the part wounded will be gnawne (as it were) with their sharpenesse and acrimony, whence will follow paine, new fluxion, inflammation, hollownesse in the vicer, putrifaction and the like; all which will not onely afflict the part affected, but also be communicated to the whole body: but if so small tents as you must vse will neither pertaine to the bottome of the wound, nor keepe it open till the strange substances and the quittance are excluded, it will bee very behoofefull in such sinuous and profound wounds to vse such an injection as followeth.

Recipe, Aqua hordei Libras quatuor, agrimonia, Centaurij minoris, pimpinella, absynthij, plantaginis, ana semimanipulum: rad. Aristolochia rotunda semi-drachmam: fiat decoctio ad libram unam. In Colatura expressa dissolue Aloes hepatica drachmas tres, mellis rosati uncias duas, bulliant modicum. This decoction you shall inject into the wound three or foure times euery dressing, and if that will not deterge the sanies sufficiently and consume the spungie, putrified, and dead flesh; you shall dissolve in your decoction as much of the *Agiptiacum* described before as you shall thinke fit: put case an ounce of the *Agiptiacum* to a pound of the decoction, for so it will eate out the spungie flesh which growes in the hollownesse of the wound, and inhibite the growth of true flesh which is not fit before the wound be sufficiently clenfed. For which end also (saith *Pareus*) I haue had experience, that the poulders of Mercury and burn'd Alume mixed in equall portions are very excellent. Many practitioners doe vsually suffer a great part of this decoction to remaine in the cavity of the wound, especially if it be sinuous; which *Pareus* worthily disalloweth, as well because the liquor remaining makes a tension or stretching of the part affected; as also because being so ouer moystened, the flesh will not so promptly be regenerated; for it is a rule in Chyrurgerie, that euery vicer as it is an vicer ought to be dried as much as may bee, and he that can dry an vicer can cure it. It is also ordinary for Chirurgeans to offend in the too frequent vse of setons or lines of hayre. For changing them often and drawing them vp and downe in the wound, they hurt the tender sides thereof, bring paine vpon the Patient more then needs, and exasperates the malady, which thereupon produces many maligne symptomes. Wherefore my counsell is (saith *Pareus*) that if the wound yeeld much matter or quittance, that the Chirurgeans vse hollow tents, so that the sanies may issue oftner then it is drest, and so Nature will be releued with lesse trouble. He also vseth to presse double ragges vpon the bottome of the wound if it can well be com'd vnto, to drinke vp the sanies, and to presse the parts a litle together, that the matter may issue; but let the Chirurgeon take heede he leaue none of the cloute in the wound: the double clothes also which he layeth ouer the orifice of the wound and vpon his hollow tents, would haue a large perforation in them, at which perforation hee may place a peece of soft sponge, to receiue the quittance as it issueth.

Now for the binding or rowling vp of the wound, the first care must be that it be not too straight, for that will inhibit the issue of rotten vapours and excrements which the bruised flesh yeelds; beside it will endanger to bring an Atrophy by keeping the alimentary iuyce from the part. Next you must take care to begin to rowle from the bottome of the wound, and so proceede to the top or orifice; for that manner of rowling leades away the quittance better. Lastly, you shall wet your clouts and rowlers with *Oxycratum* or hard wine, for that will adde strength to the part, and beside intercept a new flux of humours.

And because it happeneth many times that by reason of the vehemencie of the Collision the bones are shattered into small peeces, which at the first dressing cannot bee gotten out but remaining in the wound doe goade it greuously; I haue added an excellent and approved remedy to bring away such remainders out of *Pareus*.

Recipe, Rad. Ireos Florentia, panac. & Cappar. ana drachmas tres: Aristolochia rotunda, manna, thuris, ana drachmam unam. In pollinem redacta concorporentur cum mellis rosati & terebinth. Venet. ana uncias duabus. Or, Recipe, Resina pini sicca uncias tres, pumicis combusti & extincti in vino albo, rad. Iridis, Aristolochia, ana semidrachmam, thuris drachmam unam, squamma eris drachmas duas. In pollinem redigantur, diligenter incorporentur, cum melle rosato fiat medicamentum.

CHAP. XXVIII.

What remaines afterward for the Chirurgeon to doe.

When the skilfull Chirurgeon hath gotten out the strange substances out of the wound, and cleansed and purged it of the sanies and quittance which the Contused flesh did yeeld, so that now the wound growes dry, then he shall employ all his care to regenerate new flesh and draw a Cicatrice vpon it. Now because that is the worke of Nature rather then of medicine, therefore he shall take counsell of the learned Physitian how to institute his diet, how to physicke his body, how to proportion the cure according to the temper of his Patient and of the affected part, with such other indications as we vsually gouerne our selues by in the like cases. For the Chirurgeon shall often finde himselfe at a losse by reason of the variety of the ambient ayre and disposition of the yeare, the age, temper, and custome of his Patient, the noblenesse and sence of the part affected; to say nothing of the complication and composition of infirmities, and many other particulars which to recite belongeth not to this place. In one word, hee must endeavour two things especially: the first is that the part affected be restored to his genuine and native temper: the other is, that the masse of blood doe not offend either in quantity or quality. For if these two be right, nothing else can hinder the regeneration of solid and good flesh, and consequently the vnion of the wound. Neither toward the end onely, but from the beginning almost of the cure, the Chirurgeon shall neede the Physitians aduise for institution of diet, for oportunitie of purging and letting of blood, for easing of paine, yea in the mayne scope of the cure of the wound, good direction for vulnerary potions, will be of great vse. To say truth, a Chirurgeon cannot walke safely alone without the helpe of a Physitian in any cure almost which he takes in hand, vnlesse he be a peece of a physitian himselfe: which skill as it is ordinary in Chyrurgeans of other Nations, because they be all or most of them Schollers; so amongst vs where men get their skill in Chirurgery without Schollership by seruing seauen yeeres apprenticeship, it is very rare, and by so much the more commendable where it is to be found. But to say something of all these particulars (because a Physitian is not alwayes at hand) will not be amisse I thinke for the information of such especially who when they know a little will be desirous to learne more.

First therefore for diet: Hot and sharpe or biting things the Patient shall forbear, as wine, strong drinke, spices, salt, onyons, &c. for such do attenuate and rarifie the humors, and make them more prone to influxion. Againe, let his diet be very thinne and slender, that so the influence of humors may be restrayned from the affected part, for an empty stomacke drawes from all the parts of the body, especially from those that are neere vnto it, and by consecution euen from the outward parts; whence it is, that the first dayes you shall doe best to diet this kinde of Patient very slenderly.

For purging, it is necessary to keepe the body soluble the whole time of the cure, so that it answer once a day at least; yet it is safer to do that by Clusters then by purgations, especially such as haue Scammonie or Colocynthis in them, or any other vehement ingredient, for the agitation of humours will produce a new flux.

For bleeding it is to be obserued, that vpon a wound with Gun shot, seldome or neuer any great flux of blood followes, especially presently, because through the greatnesse of the contusion, and the vehement agitation of the ayre, the spirits are driven inward. Yea if an arme or a legge be shot off with a peece of Ordnance, no great flux of blood will instantly follow, though diuers large Veynes and Arteries be broke. But afterward, to wit, about the fourth, fift, or sixt dayes, sometimes later, you shall haue a flux of blood; forsooth because by that time the spirits and the naturall heate rerurne vnto the part. Wherefore in the beginning you shall not neede to endeavour to stay the blood, but rather giue way to the issue of it, for the effusion of some good quantity of blood, will free the part from inflammation and fulnesse too: and if the wound do not bleede of it selfe, the Chirurgeon shall finde it fit to open a Veyne the next day after the wound is inflicted, and take away as much blood for depletion and revolution as the strength of the Patient will well beare.

Now for the mitigation of paine, the Chirurgeon must haue especiall respect thereto from the very beginning of his worke. And if paine be ioyned with inflammation (as most commonly it is) it may be abated by annoynting the neighbour parts with an vnguent made of Galts grease, nourished (as we say) with the iuyce of plantaine, houselecke, nightshade and the like.

like. The Vnguent also called *unguent. diachalciteos*, described by *Galen*, dissolved with vinegar, oyle of Poppy and oyle of Roses, is as effectuell as the former. In like manner *unguentum de bolo*, and many other of the same faculty. For although these be not properly *Anodynes* (which are all hot and moyst in the first degree) but cold, yet not narcotically, they will mitigate paine, because they correct a hot distemper, and doe stay sharpe and bilious fluxions, which are farre more impetuous then those that are cold.

After the vse of such Repercussives, it will be profitable to apply this following Cataplasme.

Recipe Mica panis infusa in Lacte vaccino libram unam & semis, bulliant parum. Addendo oleorum violar. & rosarum ana uncias tres, vitellos ouorum quatuor; pulueris rosarum rubrarum; florum chamemeli, & meliloti ana uncias duas, farina fabarum, & hordei ana unciam unam: misce, fiat Cataplasma secundum artem. You may also on the sudden make it with crummes of bread boyled with oxycratum and oyle of Roses.

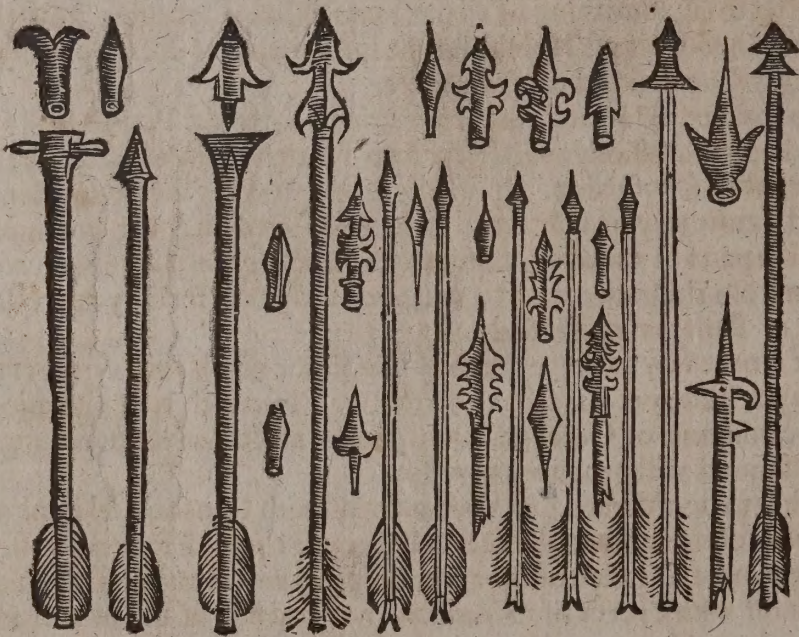
Finally, for vulnerary potions, you may goe to our Dispensatory, or make them of Plantaine, herbe Robert, Doues-foot, Camphery, Dogges-tongue, Burnet, and the like. And so much of wounds made by Gunshot.

CHAP. XXIX.

Of wounds made with Arrowes, Darts, Iauelins and other such sharpe weapons.



Here is a great difference in the cure of wounds made with Arrowes and sharpe weapons, and those made with Gunshot. For the Bullet wounds alwayes with contagion, the Arrow or Iauelin, or the like, not so. Beside, the Bullet is seldome or neuer poysoned, the Arrow often. But among sharpe weapons there is great varietie which also makes the Cure various in some degree. I will not stand to enumerate the seuerall sorts of weapons, or make any curious diuision of them, onely I will exhibite to you in one figure a multitude of their fashions especially of their heads, which will be better then any description I can make of them.



The

Beside, you have here expressed the figure of a man wounded with all kinde of Weapons, and in euery part of the body.



Againe, there is great difference in respect of the wounded part, whether it be fleshie, bony, nervous, in a ioynt, or neere a ioynt, or farther off, in a noble part: as the Braine, the Longues, the Heart, the Stomacke, the Liuer, the Guts, or such like; or in a part more ignoble; in an inward or an outward part, and according to these differences, such wounds are more or lesse mortall. In all mortall wounds it shall be for the honour of the Chirurgian and his Art, to foretell the danger: Yet not to leave any thing vnattempted which may giue hope of recouery, because as in diseases, so in wounds, it falleth often out, that what the Physitian or Chirurgian giues over as desperate, that either some good old Wife, or which is worse, some cheating Mountebanke will take vpon him to cure, and if hee, while time, with a little herbe *Robert*, till Nature preuaile ouer the disease (which many times shee

doth aboue and against our expectation) then is he famed for a second *Asculapius*. Howsoeuer it is a great disparagement to a Chirurgian, if he be called while the Patient liues to let him die with the weapon in his body, yea as much honour may be gotten by the Artificiall getting out of the weapon in a desperate case, as by curing him that is not desperately wounded. It shall not therefore be amisse, a little to insist vpon the Artificiall extraction of such weapons.

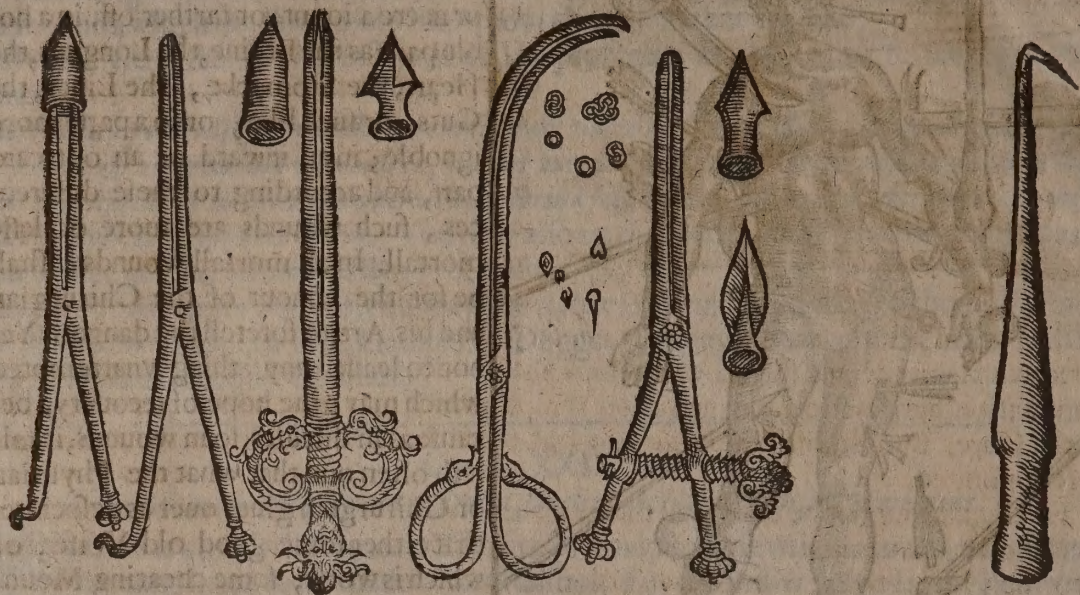
And in the first place, the Chirurgian must be forewarned that he take care he doe not his worke butcherly, with too much cutting or tearing the flesh, but especially veines, arteries, nerues or tendons, leaſt it be said of him that his hand hath done more harme then the weapon, which would be an extreame dishonour to him and to his Art.

But to the matter. There be two wayes to get out a weapon: one by the way, it went in, and that we call extraction, the other by the part which is aduerse, and that wee call expulsion.

After the very first dressing, these workes must be done, and with more ease and felicity performed if you place your Patient in the same posture he was in when hee receiued the wound, as hath beene before signified. Againe, you shall haue at hand all your Instruments, as for example. A paire of Pliers whose handles when you presse together the shankes will be diuided; those are fit to take out an Arrow head, or the head of any weapon which is hollow, for the shankes being diuided in that hollownesse, will hold the Arrow head firme and fast, and so draw it out. The next is a hollow instrument of Steele like a Cane clouen in the length, in which runnes a slender and sharpe probe, and at the handle a large screw answerable to the hollownesse of the Cane of Steele: this screw doth not onely serue to diuide the clouen cane, which by that meanes fills the hollownes of the head of the Iauelin or such like, and so drawes it out as the former Instrument did, but also if a peece of the wood remaine in the head, it presses the sharpe probe into that wood, and so drawes it out.

The next is a paire of small plyers, a little compassed at the end, and toothed within; that if the wound be oblique it may attaine to the bottome of it, and meet with any small peeces of its mayle or the like, which lie there, and bring them away. The next is a paire of plyers, with a screw running crosse the shankes of the handle, but the end of the plyers is like the Crowes Bill, or a little flatter. This screw in the handle doth open and close the Crowes Bill, as you please to take hold of the head of the weapon, though it be buried in the flesh. Lastly, it may happen that some peeces of a Linke, of a Chaine, or mayle

be in the wound, and then you may vse a hooked probe to draw them out, and this instrument is also vifull sometimes in wounds made with Gunshot, where such rings or peeces of mayle are driuen into the wound. The figures of all these instruments, you haue hereunder expreffed in the order I haue described them, for in *Pareus* the descriptions are mistaken.



Now if the head of the Pike Iauelin or Arrow be broken off short and remaine in the wound, but not to be seene, or easily to be felt; yet you shall know where it lies by a roughnesse and inequality which you shall discerne by your probe. The flesh also will be bruised and appeare liuid or blackish, and the Patient will find a heauy paine in that part of the wound, though the weapons head be so bended in the place, that it do not alwayes pricke and goad him. As sometimes the stone that falles from the kidneyes, after it hath with wonderfull torment extended the vreter will be bedded therein, and goade no more till it moue againe: and yet the Patient will finde a heauy and grauatiue paine about the place where it resteth. Vherfore when any of these signes shall put you into suspition that some part of the weapon is remaining in the wound, vse your best skill and most proper instruments to finde it, and to draw it out. And if you must of necessity vse incision doe it as carefully as you can, and auoyd the vessels and tendons of the muscles, if it bee possible, which that you may doe your skill in Anatomy will guide you whereby you shall know what large vessels runne in any part, and where the tendons of the muscles are, and after you haue made such incision as is of absolute necessity, performe the other part of the worke which is to draw out the weapon with your toothed or rough Bills or Beakes, of which I haue before intreated. And this manner of incision you shall be most constrained to vse, when the head of the weapon is not plaine but indented, bifurcated or bearded like a crosse or broad Arrow, such as our *English* men shot of old out of Long-bowes, and now we vse to shoot at Deare. But heere you shall obserue the second manner of getting Arrows &c. out of a wound called expulsion; and that is, when either it pierceth so deepe, that it is neere the aduerse part, and with a small incision may there be drawne out, but cannot be extracted by the way it went in, without great difficulty; or when the head of the weapon is so forked or indented, that if it be extracted, it will rend and teare all before it. In both these cases it may be expelled or driuen out with your blunt or knobbed probe, at the aduerse part, you hauing by conuenient incision before, made way for it. And to say truth, beside the necessity of this impulsio, the conueniency of it will countervaille the incision, because when the wound is through and through, it will be more easily deterged and after consolidated.

But if the aduerse part to the wound, vpon which the head of the weapon doth rest be a bone; or if many tendons of Muscles or much flesh must be cut to make way for impulsio, as it hapneth in the brawny parts of the body; then you shall worke by way of extraction, dilating the wound first with the Instruments fit for that imployment, forbearing the Nerues and larger vessels as much as you can, according to your skill in Anatomy. With a dilatatorie hollow in the inside, you shall labour to comprehend both the beards of the

Arrow

Arrow head, or the like, and then with the Cranes bill before described, you shall take fast hold vpon it, and so drawing out both your instruments together, you shall together with them draw out the weapon head. The manner of this operation you haue deformed in this subsequent figure.



Obserue also that if the point of the weapon be fixed in a bone, you must gently shake it; gently I say, for feare you breake the sharpe point of it, & leaue it in the bone; and when you haue loosned it by such gentle shaking, then with the Crowes Beake, or the like, you shal endeouour to draw it out. When it is out you shall presse out the blood, as you may; and if much blood follow, you shall so far suffer the flux to continue as the strength of the Patient, and the condition of the affected part will permit; for so you shall secure it from a plenitude, and from a *Cacochymie*, and beside it will be lesse subiect to paine, inflammation, putrifaction, and such other symptoms as you feare might grow vpon you in the Cure. But if those symptoms ouertake you, then must you flie to the remedies before appointed.

Finally, although it be not vsuall that weapons should be poysoned, yet because the malice of men is sometime so exalted that they are bent vpon all mischief they can deuise, you shall learne to know when a weapon is poysoned, and how to behaue your selfe in such a case. You must therefore vnderstand that weapons are almost alwayes poysoned with hot poysons, seldome or neuer with cold. That they are poysoned with hot poyson, you shall perceiue as well by the propriety of the paine, as by the condition of the wounded flesh. For the paine, first it is beyond measure greater then the paine of wounds not poysoned. Secondly, whereas the paine of other wounds is most what grauatiue and dull, that which proceeds from hot poyson, is pricking, like the continuall stinging of a Bee, we call it a stinging paine. The wounded flesh will also discouer the poyson with a pallid and liuid colour, together with some signes of mortification, beside many other malignant symptoms which doe not vsuallly accompany wounds of a simple nature. In this case as soone as the wound is cleared of the weapon and all strange substances, you shall scarifie round about the wound frequently and deepe, and after set on Cupping-glasses, with a great deale of flame which may draw mightily, that the poyson may be exhausted: you shall also get them sucked by a man or woman whose mouth and pallat is sound and not vlcerrated, and you shall let him or her hold a little oyle in their mouthes least the poyson offend them. Lastly, you shall powerfully call out the poyson with Phenigmes, Vesicatories, Cauteries, and all other manner of outward applications which your Art shall suggest vnto you, which belong not to this place.

CHAP. XXX.

Of the nature of a Gangrene.

BEcause I haue oftentimes in the former discourse told you that wounds with contusion are subiect to Gangrenate, I resolued in this place to say something of that also, though I know this subiect would require a whole Treatise by it selfe; but I am onely at this time (as I haue often said) in the explication of Instruments, and if you meet with any other Tackling by the way which may serue your turne, vnderstand it to come in by the bye, not by the maine, and out of *Pareus* for the most part, as also all the rest.

A Gangrene therefore vpon a contusion, comes sometimes by the fault of the Chirurgicalian, sometime through the error of the Patient, sometimes from the vehemency of the contusion, but most commonly from the condition of the part affected; of all which wee shall vnderstand the causes better, if we first describe the nature of a Gangrene.

A Gangrene therefore is a disposition and way to a mortification of the part wherein it is, which creepeth vpon it by degrees; and when it is consummate it is called *Sphacelus* by the *Grecians*, by the *Latines*, *syderatio*, we say such a part is mortified.

The most generall cause of a Gangrene is the dissolution of the Harmony and conternperation of the foure first qualities whereby the part is made vnfit to receiue the spirits

and faculties, as well naturall as vitall and animall, by which it is nourished, by which it liues, moues, and hath sensation; for if a part be depriued of these influences it presently languishes and shortly after dies.

The Primitiue or externall causes hereof are combustions made by things which are either actually or potentially fiery. Actually as Fire it selfe, scalding Oyle or Water, Gun-powder fired and such like. Potentially, as biting and goading Medicines, put case sublimated *Calcanthum*, and Potentiall Cauterics; for all these raise a mighty inflammation in the part. In like manner vehement perfrigerations by the ambient ayre may bring a Gangrene, as also the vnseasonable vse of cold and Narcoticall Medicines. Moreover, a Fracture, a Luxation, a notable Contusion, as I said before, Ligatures, if they be too hard and fast; the bytings of mad or poysonous beasts, the pricking of a Nerue or Tendon, the wounds also of neruous parts and of the ioynts, especially if the body be *plethoricall* or *cachymicall*: Finally, large and deepe wounds wherein the larger veines and arteries are cut asunder. For all these causes doe more or lesse, sooner or later, dissolve the harmony of the first qualities before mentioned, if the mischiefe be not seasonably preuented.

The internall and (as we call them) Antecedent causes of the Gangrene, are the plentiful confluences and defluxions (and those sudden) of hot or cold humors vnto a part. For the faculty of the part being not able to gouerne them, it commeth to passe, that the inbred heat for want of transpiration is suffocated and extinguished. For by this defluxion the Arteries are so straightned, that they cannot dilate and contract themselves by ordinary pulsation, whereby the naturall heate is cherished and contempered. But then especially is the Gangrene most incurable when that defluxion of humors, seales first vpon the bone and from the bone the inflammation takes his originall. Yea, the bone is not onely first inflamed (I meane the *periostion* which couers it) but also the very substance of the bone is at the first hand tainted with a caries and rottenesse, as in the *French* disease and the *Le-prosie*; especially in the *French* disease you shall haue a mans flesh plumped and sound, and his skin faire and smoothe, and yet his bones rotten, and as it were worme-eaten. And this alwayes from a venemous matter which lies dogging and gnawing vpon the bone. And this poysonous matter is sometimes hot, as in Plague-sores which will Gangrenate now and then within two houres; sometimes it is a cold poyson, as the poyson of the Pox (which is not so quicke) and other secret poysons satling in particular parts, whereof out of *Pareus*, I could giue diuers instances, one of mine owne experience you shall haue. A Gentlewoman of *Norfolke* made great cōplaint to me of a paine in her forehead, yet there appeared no inflammation or tumor, within two or three dayes in the middle of her forehead appeared three blew spots as big as Pease, and in other two or three dayes, they grew blacke but no bigger, and the mortified flesh fel out to the very skull, & suddenly healed vp againe without any more trouble. I perswade my selfe this sudden mortification could proceed from no other cause but some poyson, which issued out at the Commissure of the skull, which is called the sagittall suture, and in women diuideth the bone of the forehead.

I say not that such a sudden Gangrene cannot proceed from any other cause but from poyson. For it is not extraordinary, that it should come from the temerarious vse of Narcoticall medicines, sometimes also from the keene and penetrable cold of the ayre in Winter, whereby the spirits and naturall heate of a part is vtterly extinguished, and the influent heate beaten backe. For when a part is so frozen, the influent heate cannot pierce it, or if it doe, it cannot remaine in it, but is beaten backe or arrested and put out. Note here that the Gangrene which proceeds from extreame cold, doth especially occupy those parts which are farthest off from the heart which is the source of heate, as the feet and the hands, or else those parts which are of their owne temper cold, as the gristles of the eares and the nose.

CHAP. XXXI.

Of the signes of a Gangrene.



He nature of a Gangrene thus explained, we come to the signes. If therefore it proceed from an inflammation or phlegmony, the paine and pulsation will cease, without iust cause, that is to say, without resolution, suppuration of the tumor, and the flaming and ruddy colour of the part will suddenly grow browne or liuid. By pulsation here I doe not meane onely that beating which

which proceedeth from the distempered Artery, but that dolorous beating which is begotten by the contention betwene the naturall and preternaturall heates, which contention proceedeth from certaine crasse vapours arising from the humors which the Gangrene shuffeth vp and downe and setleth a bad impression vpon. If the Gangrene proceed of cold, then presently and vpon the sudden, an acute pricking and burning paine inuades the part; for, penetrable *frigus adurit*, as the learned Poet saith. Another signe is, if the flesh and bright rednesse of a part, such as will appeare in a mans hand that rowles a Snow-ball, be suddenly turned liuid and wanne. Againe, if in stead of an extraordinary heat that was in the part, presently it becomes cold, nummed, stupid, and that not without a sensible horror, as if it were seased vpon and shaken by a cold fit of a quartaine Ague. If this cold increase so farre that it vtterly extinguish the naturall heate, then a mortification will follow vpon that Gangrene; and beside, oftentimes convulsions and violent contusions of the whole body, whereby the braine and the vitall parts are grievously disquieted.

Those Gangrenes which come vpon too hard Ligatures, vpon Fractures, Luxations, and contusions haue alwayes an hardnesse accompanying them, which is caused by attraction and incurfion of humours. Many times certaine pustules and blebs rise vpon the skin confining, which are caused by a notable ardor not farre from a degree of combustion. The member also Gangrenated, is more heavy and weighty then of due it ought to be, because there is want of spirits to ballance and poyse the Moles or mountenance thereof, and to support it. Againe, if you presse a gangrenated part, somewhat hard with your finger, it will leaue a print and footstep behinde it, as it doth in an *Oedema*, proceeding from the drop sic, or the like disease. Finally, in a Gangrene, the skin without any iust cause, will easily shire from the flesh, yea, sometime the whole and true skinn, not the cuticle onely.

If the Gangrene proceed from the biting of a mad Dogge; or of any other venomous Beast, the pricking of a sinew, the breaking, as it is called, or rather the extension of an Artery called *Aneurisma*, or from some notable wound in a phlethoricke body, or which is oppressed with a *Cacoehymia*; or in a part of exquisite sense; all these Gangrenes shall bee discerned by the same signes, by which we discerne a Gangrene proceeding from inflammation, of which I spake before. For these and the like causes, doe cause attraction, and fluxion of humours, into a part more then the ingenie of the part will beare, or can moderate and regulate, and so perspiration being intercepted, and the pores stopped, there followes necessarily an oppression and suffocation of naturall heate and a Gangrene, which are tearmes convertible.

Here saith *Pareus*, I would admonish the yong Chirurgian (he might haue put in all) that when from these signes before named, he knowes the place is Gangrenated, and that a Necrosis or mortification will follow (for that I presume is his meaning) that he doe not protract time, but as soone as he can prepare himselfe and his Patient, that he proceed to Amputation or dismembring, although there remaine some sense in the part, or some small motion. For oftentimes in this case, the member is not moued by the motion of the whole muscle, but haply the head of the muscle is not yet gangrenated, which sound head, whilest it moueth it selfe, it also moueth the tendon or taile of the muscle which is continuall with it although it be already mortified. Wherefore to delay in such a case is dangerous. But of this we shall speake further by and by. In the meane time, I will adde something of the Prognosticke, which a Chirurgian ought to giue vpon a Gangrene. For, as in all other desperate Cures, it becomes him well to declare the danger his Patient is in, to secure his owne reputation, and to asser the honour of his Art, which lies at stake as well as his credit. So especially in the case of a Gangrene, the rage and malignity of which disease, is so great, that it will out of hand, not onely kill the part affected; but by contagion also sease vpon the neighbour parts, and in time vpon the whole body. For a Gangrene is a very poyson which turneth all it meets with into his owne nature, or if you will, like fire (though not so like) it eats, feeds vpon, and depopulates whatsoever comes into his way. Againe, *Hippocrates* in his booke *De vulneribus Capitis*, saith; *There is no proportion betwene the Liuing and the Dead*. And therefore you must say, that the dead part must presently be separated from the liuing, *Ne pars sincera trahatur*. Moreouer, when your Patient shall haue a cold sweat arise vpon his whole Body, when a *delirium* takes him, and that he cannot sleep, when the Hickocke and abrupt belchings come vpon him; finally, when he is overtaken, with frequent returning, faintings and sowndings, then you may prognosticate, that death is at the doore. For all these symptomes are caused by vapours which arise plentifully and

perpetually from the corruption and mortification of the humors and the flesh, through the veines, arteries and sinewes, vnto the noble parts. Finally, when thou hast thus provided for thy owne reputation, and the honour of thy Art, by acquainting the friends of thy Patient with the danger; then if thou finde any hope at all of curing or intercepting the progresse of the maladie, hasten to thy worke.

CHAP. XXXII.

Of the Cure of a Gangrene curable, before it come to perfect mortification.



He Indications of curing Gangrenes, are taken from their variety, the variety I meane of their essence and magnitude. For some Gangrenes occupy a whole member, others onely a part of a member; some are profound and deepe, others outward and superficially. The state of the body is also to be considered: for soft and delicate bodies, as are the bodies of Children, Women, Eunuches, and those that liue idly, doe require more milde and gentle medicines, then those bodies which by Nature, Custome, and Trade of life, are stronger and harder, as of Husbandmen, Laborers, Marriners, Huntsmen or Hunters, Porters, and such like; who liue thriftily and courselly. Againe, there is consideration to be had of the affected part, for there is a difference to be made betweene the Cure of a Gangrene in a fleshy and musculous part, and in a solid part, as those which are neruous, and in, or about the ioynts or the bones. Moreover, such parts as are hot and moist, as the secret parts, the mouth, the wombe, and the fundament, are more easily and sooner tainted with this manner of corruption, and therefore you may sooner apprehend the danger, and consequently with more speed set vpon the Cure. And first of all if the Gangrene proceed from inward causes, you shall call for the aduice of a Physitian to prescribe his dyet; as also if the body be Plethoricall or Cachoymicall, to aduise concerning Letting of Blood and Purgings. The heart also must be fortified and corroborated to defend it against the Transfusion of vapours arising from the affected part, by inward Cordials, and outward applications, as Epithemations, and the like. All which I leaue to the care of the Physitian.

But if the Gangrene proceed from a plentiful influxion of blood or humors, as vpon a great phlegmone, or the like, the cure shall be begun by euacuating and drying vp of humor which haue putrified in the pained part. To this purpose, you shall vse scarifications and incisions, deeper or more superficially, as the condition of the Gangrene shall require, that the part being so exonerated, may haue the benefit of perspiration, and the concluded humours of distillation, and vent made for the fuliginous and sooty excrements which abound in it.

Incisions you shall make with the Phlegme or Penknife, deepe and manifold when the Gangrene is great, profound and neere to mortification: As when it reacheth neere the bone: yet you must haue great care to auoyde the most notable Nerues and Vessels, vnlesse they be vtterly mortified, and make your sections in the distances betwixt them. If the Gangrene be lesse, you shall be contented to vse onely scarifications. For this purpose *Pareus* hath an instrument which he calleth the *Scarificator*. It is a box wherein are fastened many rownd wheelles as it were, sharpe as phlegmes, which by a handle fitted into the side of the box are made to strike all together, so that with this instrument you shall make as many scarifications at once as the phlegme will doe at many times, and beside all of one depth. The instrument with the couer is hereunder expressed.



When

When scarification is thus made, then shall you foment the part with wine-vineger, wherein you shall boyle Radish rootes, the rootes of *Serpentaria maior*, of *Arum*, and *sigillum Salomonis*, *Auripigmentum* and the like. For these sharpe medicines doe powerfully warme, resolue, and draw the clodded blood from the bottome into the skin, which otherwise will interclude the passage of the spirits, whereby the integrity of the part is preserved, and beside extinguishes the naturall heate. But in this administration you must be very cautious, least together with the clodded and grumous blood, you draw also the blood out of the veynes. Againe, you must be carefull you vse not these drawers till you be sure the influxion of blood is stayed. If the contusion be but small, you shall dissolue Virgine waxe with Cumine seede, Cloues, and the roote of our Ladies scale. The Emplaister which followes doth powerfully discusse grumous or clodded blood.

Recipe Picis Nigrae uncias duas, Gummi Elemi unciam unam semis, Syracis liquida & Terebinthina com. ana semi-unciam, pulveris sulphuris vivi unciam unam, Liquefiant simul, fiat Emplastrum, extendatur super alutam.

Sometimes you shall finde that vpon scarification the blood will issue freely of it selfe, suffer it on Gods name so to doe, till you thinke the part is well vnburthened, then foment it with medicines which will warme, dry, resolue, deterge and open, all which faculties will chaunce and correct the putrifaction. Let them also be penetrant to consume the virulence which is infixed. For that purpose make Lotions of the Lee which is made of the Ashes of the Oake, wherein you shall boyle *Lupines* till they be very tender. Or for more expedition, take salt water and in it boyle *Aloes* and *Agyptiacum*, and adde a little *aqua vita* in the end of the decoction, for *aqua vita* and *Calcanthum* burnt into ashes, are singular remedies for the Gangrene. Or,

Recipe, aceti optimi libram unam, mellis Rosati uncias 4. Syrupi acetosi uncias tres, salis communis uncias 5. bulliant simul, adde aqua vite semilibram. Wash the part often with this water, for it is of great vertue to inhibit the spreading of a Gangrene. After this washing you shall lay on pledgets with *Agyptiacum*, and also with your Probe presse them into the incisions if you haue made any, and that will meruailously repress putrifaction, and inducing an Eschar, will separate the rotten flesh from that which is sound. For in this case you must not expect till the rotten flesh separate of it selfe, but if you perceiue any part of it to bee corrupted, you shall with your knife or sheeres cut it off; after put in *Agyptiacum* as often as neede shall require, and how often neede shall require you shall discern by the colour, smell, and sensibleness of the flesh. The *Agyptiacum*, whose vertue I haue often proued admirable, saith *Pareus* in such cases, is thus made.

Recipe, floris eris, Aluminis Roch. mellis communis ana uncias tres, aceti acerrimi uncias quinq., salis Com. unciam unam, vitrioli Romani semi unciam, Sublimati pulueris, arachnas duas, bulliant omnia simul ad ignem, fiat unguentum.

After you haue intimated the *Agyptiacum* into the incisions, lay on the following *Cataplasme*, for it stops putrifaction, it resolues, deterges, dryes vp the virulent sanies, and by reason of the dry tenuity and subtilty of the parts of it, it pierces deepe into the member, corroborates it, and beside, it is an *Anodyne*.

Recipe, Farina fabarum, hord. prob. Lent, lupi. ana semilibram, salis com. & mel. rosat. ana uncias quatuor, succi absynthij, marrub. ana uncias duas semis; aloes, mast. myrrha & aqua vite, ana uncias duas, oxymelites simp. quantum sufficit: fiat Cataplasma molle secundum artem. Aboue the Gangrene you shall lay this defensatiue to repress the influxion of humours into the part, and the vapours from ascending from the rottenesse into the whole body.

Recipe, Olei rosati & Myrtillorum, ana uncias quatuor: succorum plantag. solani. semper-vivi, ana uncias duas, Album. ouorum quinque, Boli Armen. terra sigillata subtiliter pulueriz. ana unciam unam; exygerati quantum sufficit: misce ad usum dictum. All these applications must be oftentimes renewed: But if the disease be so stubborn that it will not yeeld to the medicines aboue described, then you shall proceede to Cauteries; after the application whereof *Galen* commandes that you apply the iuyce of Leekes wherein beaten salt shall be dissolved. This is a penetrating and desiccating medicine, and therefore is avaleable to resist putrifaction.

If the Cauteries do no good, then must you arise vnto the extreame remedy of all, and that is amputation of the Gangregated part; but first bee sure you vnderstand sufficiently that the part is mortified, for it is no small error if vpon your mistake a man lose a member vnneccessarily. Wherefore before I come to the manner of Amputation, I shall breefely set downe the signes of perfect mortification.

CHAP. XXXIII.

Of the Signes of a perfect Necrosis or Mortification, and of the place where you should dismember.



That the Gangrene is become a *Sphacelus*, and that the part is vnterly mortified and dead, you may know assuredly, if the colour of it be blacke, and if it bee cold to feele to, and yet the weather not frostie: if it be very soft, so that the part of the flesh which is pressed downe with the finger doth not rise vp againe but leaues the print of the impression behinde it: if the skinn come from the flesh vader it; if it exhale so odious a stench (as it will doe, especially if the *Sphacelus* be vicerated) that those which stand by cannot indure it. If a sanious liquor thicke, Greene or blacke issue from it, if the part haue neither motion nor sence, when it is shaken, strooken, pricked, burnt, or cut. But here I must aduise the young Chirurgian to be circumspect that he be not misguided in his opinion concerning the want of sence in the part Gangrenated. For the Patient who was vsed to extreame paine in the part before it was mortified, will after the mortification vpon that remembrance, complaine as much if it be pricked as he did before, but you must know that this is a false sence, and proceedeth rather from the strength of imagination then because there is any true sence in the part. That this is so appeareth most plainly, sometime after the amputation of the member, for they will a good while complaine of the paine of the part after it is off: yea it hath beene knowne that some Months after the leg was dismembered, the Patient hath complained of the paine of that leg. This is a strange thing and hardly to be credited were it not for the eye and eare witnesses who haue avouched it. Wherefore when the signes before remembred shall perswade you to take off a part, let not the conceit of your patient cause you to protract time lest the whole body bee drawne into Contagion and so the opportunity of sauing a mans life and of magnifying your Art be forfeited.

Yet before I come to the manner and Art of amputation or dismembring, there remains one thing of great Consequence to bee discuffed, and that is in what place of the member the dissection ought to bee made, for herein will consist a great part of the Chirurgians reputation. Your Art commands that you should in amputation touch that part which is liuing and make your incision in sound flesh. Againe the same Art Commands you that (as much as it is possible) you should preserve the liuing part of the member. To cleare this difficultie *Pareus* giues an instance. Suppose the foote bee Sphacelated as high as the ankles, where will you dismember &c. For vnlesse you take hold of the liuing flesh, though you forbear neuer so little of that which is mortified, according to the nature of poyson (as I sayd before) the mortified flesh will by contagion gaine by degrees vpon the whole body and turne all into his owne corruption, wherefore you shal rather cut off a little of that which is sound then leaue neuer so little of that which is mortified. Notwithstanding it hapneth sometimes that the more commodious vse of that part remaining, some times the decencie will perswad you to take off more of the liuing part then the necessitie of the *Sphacelus* doth require. As in the case before named you shall make your amputation five-fingers bredth below the knee. For so the patient shall be able to vse the rest of his legg better: otherwise if you dismember as neere the ankles as the life of the legge will permit, the Patient will bee more troubled in his gate. *Pareus* names a Capraine whose leg about the ankle was shot off in a sea fight. The wound was healed; yet was the long stumpe so troublesome to him that hee caused it againe to be cut off five fingers vnder the knee, and then with a wooden leg he was able to moue nimble all his life after. But if such a chance should happen in the arme, you must not do so, but preserve as much of the liuing part as you can, for a man goes not vpon his armes or hands, as he does vpon his feete and legs.

CHAP. XXXIII.

Of the Art and manner of dismembring.



In the Art of dismembring, the first consideration to be had is of the strength of your Patient; wherefore you shall consult with the Physitian to nourish him with meates of good inyce and of easie concoction and which breede many spirits, as the yolkes of egges, bread tosted and put into good wine. Then you shall place him decently and securely and gather vnto the sound parts of his body, and then binde the part

part with a fast and some what painfull ligature, a little aboue the place where the incision shall be made, and the band shall be strong and somewhat broad like a womans fillet. This ligature hath a threefold vse: the first is, that it holds the muscles together with the skinne somewhat vp, which after the worke administred falling downe, couer the extremities of the diuided bones; and after the Cicatrice is induced, become like a quishion to keepe them from offence: adde herevnto, that by how much more flesh and skinne there is about the extremity of the bones, by somuch the sooner will the Cicatrice grow vpon them. The second benefit of the ligature is, that it prohibits the flux of blood by compressing and intercepting the continuitie of the veynes and arteries. The third is that it brings a stupor vpon the part, and takes away for the time that quicknesse of sense which otherwise it would haue, by intercluding the passage of the Animall spirits, so that the Patient fees not the paine of the incision so much as otherwise he should.

When the ligature is thus fastned and the sense of the part therewith a little nummed, then with such an instrument as is herevnder described, made keene and sharpe for the purpose, you shall suddenly circle the flesh about to the very bone.

A hooked knife fit to dismember with.

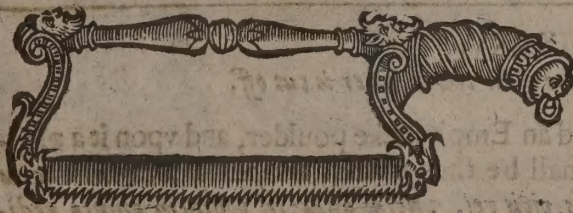


Note here that sometimes among the bones there lies some parts of the muscles which you cannot easily come at with this instrument, nor with an incision knife. If there be any such, you shall diuide it as well as you can, and separate it from the bone, because if you leaue it to be diuided

from the bone by the Saw, you shall put your Patient to great paine, for the saw will be cloyed therewith.

As soone as you come to the cleare bone, set on your Saw, which shall bee made after this manner, and about fiftene inches long.

The Figure of the dismembering Saw.

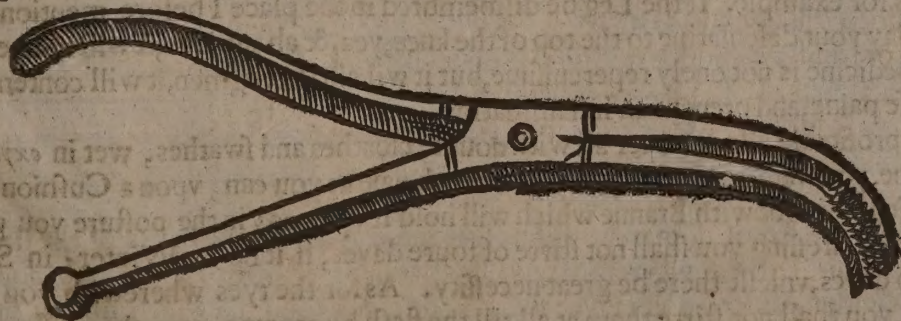


A stroke, two or three (if the Saw bee good) will dispatch the businesse, and then you shall haue a fine Raspe in a readinesse, wherewith you shall leuigate and make smooth the asperitie and roughnes which the Saw made vpon the bone.

The flux of blood which shall follow the operation, you shall not suddenly stay or inhibite, but suffer it to flow according to your Patients strength, that the part may be lesse subiect to inflammation and other symptomes.

When you would stay the blood, you shall with this instrument which is most like the Crows beake, apprehend the ends of the vessels which you shall finde among the flesh of the muscles; and it shall not matter much though with the vessels you comprehend with your instrument some of the flesh also; for there will follow no danger vpon it but rather a profit, because the flesh will helpe to consolidate the vessels.

The Crows Beake to draw the vessels out of the flesh, that they may be tyed up to stay their bleeding.



When

When you have so gotten hold of the vessels with this instrument, you shall tye them with a double and strong thred, and then loosen the Ligature you make above the place of the amputation: next with a sharpe needle and a thred, you shall with foure stiches, but taken deepe into the flesh, and crossed asslant like the letter X, sew vp the flesh and the skin somewhat loosely to couer the end of the bone, that it take not the ayre. For if you should endeouour to draw it close, and make the skin meet, your stiches would breake, and your worke would be interrupted; beside, way must be left for some quittance to issue, or else the wound will not heale.

But if by chance, or for want of care, any of the vessels which you tyed be loosned, then you shall againe cast on your Ligature with the fillet about the incision, as you did before, or else let your seruant with both his hands so compresse the member, that his fingers may stop the flux of that loosned vessell, which he may well doe if you haue skill in Anaromy. Then shall you your selfe haue a needle ready about foure inches long, square, and with sharpe edges, and in it a strong thred three or foure double, with which you shall knit the loosned vessell. After this manner as I expresse *Pareus* his relation. First, you shall marke where the vessell lies, and enter your needle on the outside of the flesh, opposite to it, and somewhat deepe, but halfe a fingers bredth, wide on one side, and guide your needle obliquely toward the vessell, that it may issue againe immediately beyond the orifice of it; then enter your needle againe within lesse then a strawes bredth where it first issued, and guide it obliquely vnder the vessell through the flesh (somewhat deepe likewise) and issue it a whole fingers bredth from the place where the first stich entered; so shall you haue the two ends of your thred on the outside of the flesh, and a fingers bredth distant. In that distance, you shall lay a pledget of a fine ragge, twice or thrice double, and then knit the ends of your thred in a fast knot vpon the pledget, straining them a litle, and that straining will so comprehend the vessell that it cannot bleed. Beside, the pledget will keepe the knot from penetrating the flesh, and you shall not doubt but the mouth of the vessell will grow quickly together with the flesh, that there will be no feare it should grow againe. Or if a few drops of blood fall, you shall be assured they come not from that, but from some other small vessell which will also be easily inhibited by the application of those adstringent medicines which we shall in the next place speake of.

CHAP. XXXV.

What the Chirurgian must doe after the member is cut off.

Irst, he shall strew vpon the wound an Emplasticke poulder, and vpon it a pledget of dry Lint. The Poulder shall be thus made. *Recipe Boli Armeni uncias quatuor, farina velatilis uncias tres, picis res. uncias duas: in pollinem omnia redigantur & ex mixtis fiat puluis.*

When you haue thus dressed vp the wound, in the next place you shall provide a defensatiue for the member, which may repell the concourse of humours which otherwise would flow to the wounded part, and that you shall make in forme of an vnguent, after this manner.

Recipe Albumina ouorum vi. boli armeni, sanguinis draconis, gypsi, terra sigillat. aloes, mastis: Gallarum Comb. ana uncias duas: in pollinem redigantur omnia & bene agitentur addendo ol. rosarum & mirti: ana unciam vnam: fiat defensivum ad formam mellis.

This vnguent shall be administred with stupes moistned with *oxycratum*, which stupes shall be so large, that they may not onely couer the member it selfe, but also the neighbour-parts. As for example. If the Leg be dismembred in the place I before mentioned, yet you shall lay your defensatiue to the top of the knee; yea, & about it to, it will not be amisse, for this medicine is not onely repercussive, but it wil also strengthen, it will contemper the blood, ease paine, and preuent an inflammation.

It will be profitable also to couer all with double cloathes and swathes, wet in *oxycratum*: which done, you shall lay the member at as much ease as you can, vpon a Cushion not filled with Feathers but with Branne which will hold it vp steady in the posture you place it in. This first dressing you shall not stirre of foure dayes, if it be in Winter; in Summer not of two dayes, vnlesse there be great necessity. As for the tyes wherewith you knit vp the vessels, you shall not stirre them at all till the flesh be growne vpon the orifices of the vessels. Which you shall hasten with this poulder, which is refrigerant, adstringent and emplastickall.

emplasticall. *Recipe Boli armeni, farina hordei, picis ref. Gypsi, ana uncias duas. Aloes, nuoum cup. Cort. gran. ana semunciam: incorporentur omnia simul, fiat puluis subtilis.* Strew it vpon the whole wound for three or foure dressings, then onely vpon the vessels, and that doe eight or tenne dressings, till you be past feare that they should bleed againe. In the meane time vpon the rest of the wound you shall apply a digestiue, till it become purulent, that is, till you perceiue the quittance to succeed; then you shall forbear the digestiue and apply *detergents* and *mundificatiues*. Such as this is which followes.

RR. Terebint. Venete Lota in aqua vite, uncias tres, mellis ros. Colati unciam unam semis, succorum plantag. apij, Centaurij minoris ana unciam unam, bulliant omnia simul ad consumptionem succorum, auferantur ab igne addendo, farina fabarum & hordei ana semunciam Theria. Gal. drachmas duas, aloes, myrrha, Arist. ana unciam unam semis, Croci semi scrupulum, fiat mundificatiuum.

I said before, that it is ordinary for the Patient, long after the member is cut off to imagine he yet hath it, and that he feelles paine in it. Now you must know that this is not altogether without cause. For the nerue or sinew which is cut in sunder contracts it selfe towards his originall, and that contraction induces a paine much like a convulsion. For as *Galen* writeth in his booke, *De motu musculorum*, the proper action of a nerue and a muscle is contraction. Their tension is not so much an action as a motion. Wherefore you may ease that convulsive paine, by anointing the ridge of the backe, and the whole member also, with this following Liniment.

Recipe, Salvia, Chamepytheos, Maiorana, roris marini, mentha, ruta, Lanendula ana m. i. Florum Chamemeli, meliloti, summitatum Anethi & hypericonis ana: p. ij, baccarum Laur. & Iuniperi, ana uncias duas, Rad: Pyrethri drachmas duas, Mastich. Asa odorat. ana unciam unam semis, Terebint. Venete libram: olei Lembr: anethi, Catellorum ana uncias sex, olei Terebint. uncias tres, Axungia Hum: uncias duas, Croci drachman unam, vini albi odoriferi Libram, Cera quantum sufficit, conuendenda contundantur, puluerisanda pulueriscentur, deinde macerentur omnia in vino per noctem postea coquantur cum oleis & axungia predictis in vase duplici, fiat Linimentum secundum ariem. In fine adde Aqua vite drachmas tres.

In the meane timewhilest your Cure thus proceedeth, you shall haue a diligent respect to the scaling of the bone or bones which your Saw touched, and the aire tooke in your operation, for they must scale. You shall therefore at conuenient time, with an actuall Caustery, that is, with a hot iron seare them so carefully that you touch no part of the flesh or the vessels; neither must you much hasten the scale away, but moue it lightly now and then, and commit the rest to Nature, which haply will shoot them within thirty dayes after the dismembring, it may be later. Finally, after all this is done, when there arises any proud and spungie flesh, you shall sneape and prohibite it with Catheretickes, as *Caleanthum verum, puluis Mercurij*: and the like; especially boyled (or as we call it) burnt Alum in poulter, is excellent in this case, whether you vse it by it selfe, or mingle it with the rest.

This Course you shall continue till the wound be healed, and the Cicatrice bee growne vpon it: altering your medicines as your discretion, and the condition of the wound shall aduise you, according to the Method before proposed.

CHAP. XXXVI.

Pareus his Reasons, why for the staying of the blood, when a member is cut off, he doth not vse the ordinary way of Cauterizing with the hot iron, but this which we haue before related.

Confesse (saith *Pareus*) that I was wont to stay the Flux of blood which followed vpon dismembring after another manner then I haue before set downe, but I am sorry and ashamed that I haue so done, yet I therein followed the practise of my Masters and Teachers, who thought themselues sufficiently furnished to stay a flux of blood when they were provided of hot Irons and Causticke Medicines which they might vse at their discretion. Now I cannot remember my former practise without horreur. For it put my Patients to insufferable paine, because the operation was administred vpon liuing and sound flesh, whose sense is most exquisite. Neither indeed can any Causticke be applied to a Nervous part, but the vehement impression of the fire, will be suddenly communicated to the *Viscera* or noble parts, wherupon must needs ensue many dire symptoms and oftentimes death it selfe: For in my account, saith *Pareus*, I haue scarce knowne, that the third part of such as haue been so dealt with, haue escaped, and those not without great difficulty;

difficulty: because those wounds which are burnt or seared, are very hardly brought to a Cicatrice, for the burning stirres vp insufferable paines, from whence come Feauers, Convulsions, and the like, or worse accidents. Adde hereto, that after a Causticke, when the Eschar falls off, there often happens a new Flux of Blood, and then the Causticke must bee applied againe; which is to torment the Patient, not onely with an insufferable, but with an often returning paine, in the application of the Causticke, iterated againe and againe, by which repetition, the fleshy and neruous substance of the part, is by degrees consumed, and so the bones laid bare; so that diuers such Patients could neuer get a Cicatrice to grow vpon the wound, but haue carried an Vlcer in the place where the member was cut off, all the dayes of their miserable life. Beside, where such an Vlcer is, it is not possible to weare an artificiall Arme or Legge, which we see many doe, so cunningly adaped that it cannot easily be discerned by others, nor very much missed by him that wants it. Wherefore, faith *Pareus*, I earyestly intreat all Chirurgians, that then would (being admonished) giue ouer that cruell and Butcherly kinde of Curation, and Practise this which I haue prescribed, taught me, as I interpret it, by the suggestion of some good Angell. For I neither learned it of my Masters, nor of any other man, onely I read in *Galen*, in the fift Booke of his *Method*, that to stay a Flux of Blood, there is no remedy so present as to tye vp those vessels that bleed toward their roots, that is, toward the Liuer and the Heart. Now I conceived that this doctrine of *Galen*, for the binding and sewing of Veines and Arteries in fresh wounds, might well be vsed in the like vessels after a dismembring, and therefore I put it in practise; yet so that in the beginning, I had alwayes Cauteries and hot Irons in a readinesse, that if my proiect sayled, I might flie to my abhorred, but necessary reliefe. But when I had the experience of the facility, and the felicity of the course I now hold in a multitude of my Patients, then I had an eternall adue to Causticke and hot Irons in this operation. And thus I wish all Chirurgians to doe. For it is not in our Art as it is in Ciuill affaires that Prescription, Law, or Authority should preuaile ouer right reason.

FINIS.



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The Contents

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2. The second part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

3. The third part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

4. The fourth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

5. The fifth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

6. The sixth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

7. The seventh part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

8. The eighth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

9. The ninth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

10. The tenth part of the work is divided into three books. The first book contains the history of the world from the beginning of time to the present. The second book contains the history of the world from the present to the future. The third book contains the history of the world from the future to the end of time.

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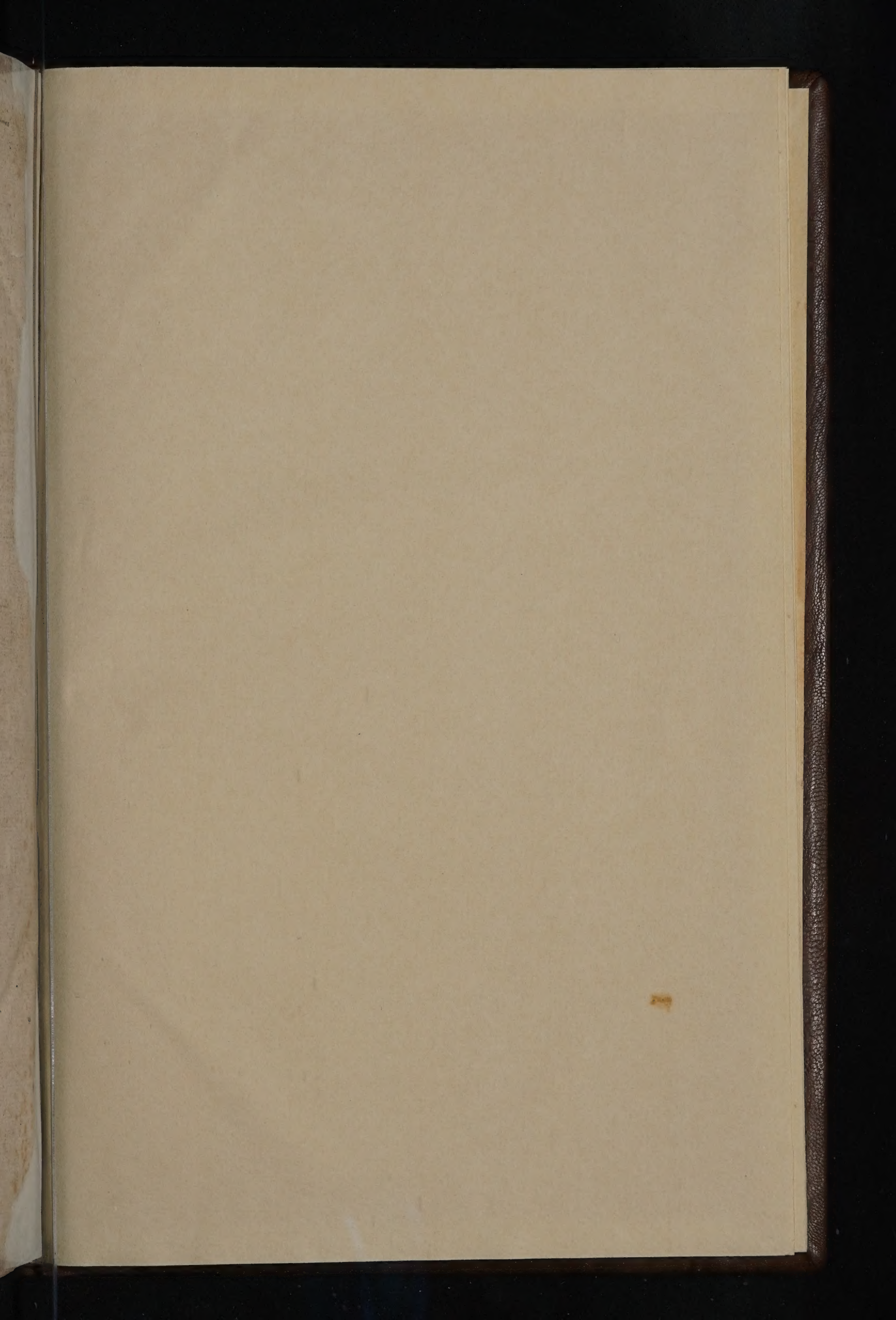
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Page 8 line 23. read maimed. p. 32 l. 9. r. mesenterie. pag. 32 l. 3. r. are p. 37. l. 19. r. superstitious. p. 55. l. 2. r. fracture. l. 49. r. expedite. l. 57. r. corosive. p. 56. l. 4. r. *parua* p. 72. l. 35. read smootheth. p. 78. l. 1. r. read Nauill. pag. 93. l. 32. r. any pag. 97. l. 52. read *porus*. p. 121 l. 17. r. manner. p. 131 l. 4. r. *pars*. l. 12. r. couer. p. 132. l. 15. r. to haue many others. p. 137. l. 17. r. *porus*. in the explication at x. r. values. p. 172. l. 3. r. *Vesalius*. p. p. 180. l. 3. r. it. p. 188 l. 36. r. of. p. 334 l. 35. r. *agri*. p. 24. l. 1. vnder the table r. doe. p. 246 l. 6. *lyma* put out doe. p. 389 l. 6. r. are. p. 431 l. 24. r. the. p. 444 l. 13. r. compressed. l. 6. r. contraction. p. 469 l. 55. r. doe. p. 488 l. 15. r. and seuerall parts. p. 499 l. 6. r. concepracles. p. 506 l. 2. r. in which. l. 3. r. braine. p. 508 l. 26. r. not to affe fame. p. 532 l. 2. r. hairy Scalpe. p. 550 l. 32. r. rainebow. p. 552 l. 14. r. animal. p. 591 l. 39. r. found. p. 592 l. 37. r. beginning p. 682 l. 20. r. it. p. 684 l. 40. r. perception. p. 686 l. 14. r. the Sunne. p. 687 l. 41. r. fight. p. 692 l. 17. r. a Resonance p. 696 l. 11. r. stor y bone p. 698 l. 48. r. esse. p. 702 l. 38. r. *Placentinni*. p. 703 l. 15. r. ineptitude. p. 707 l. 40. r. faith. p. 709 l. 35. r. breast. p. 712 l. 22. r. make no sensation. p. 715 l. 10. r. Chewing is not.

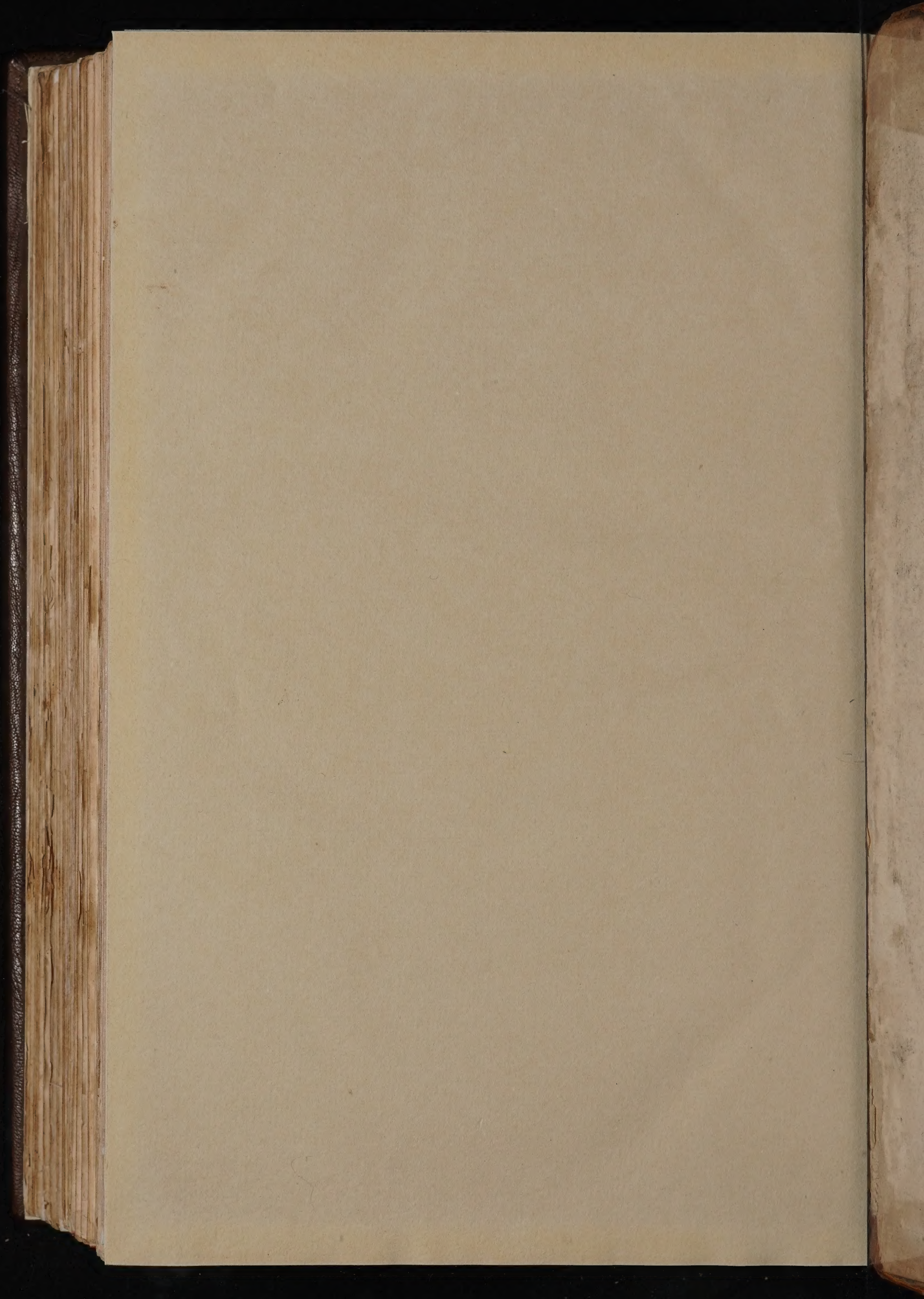
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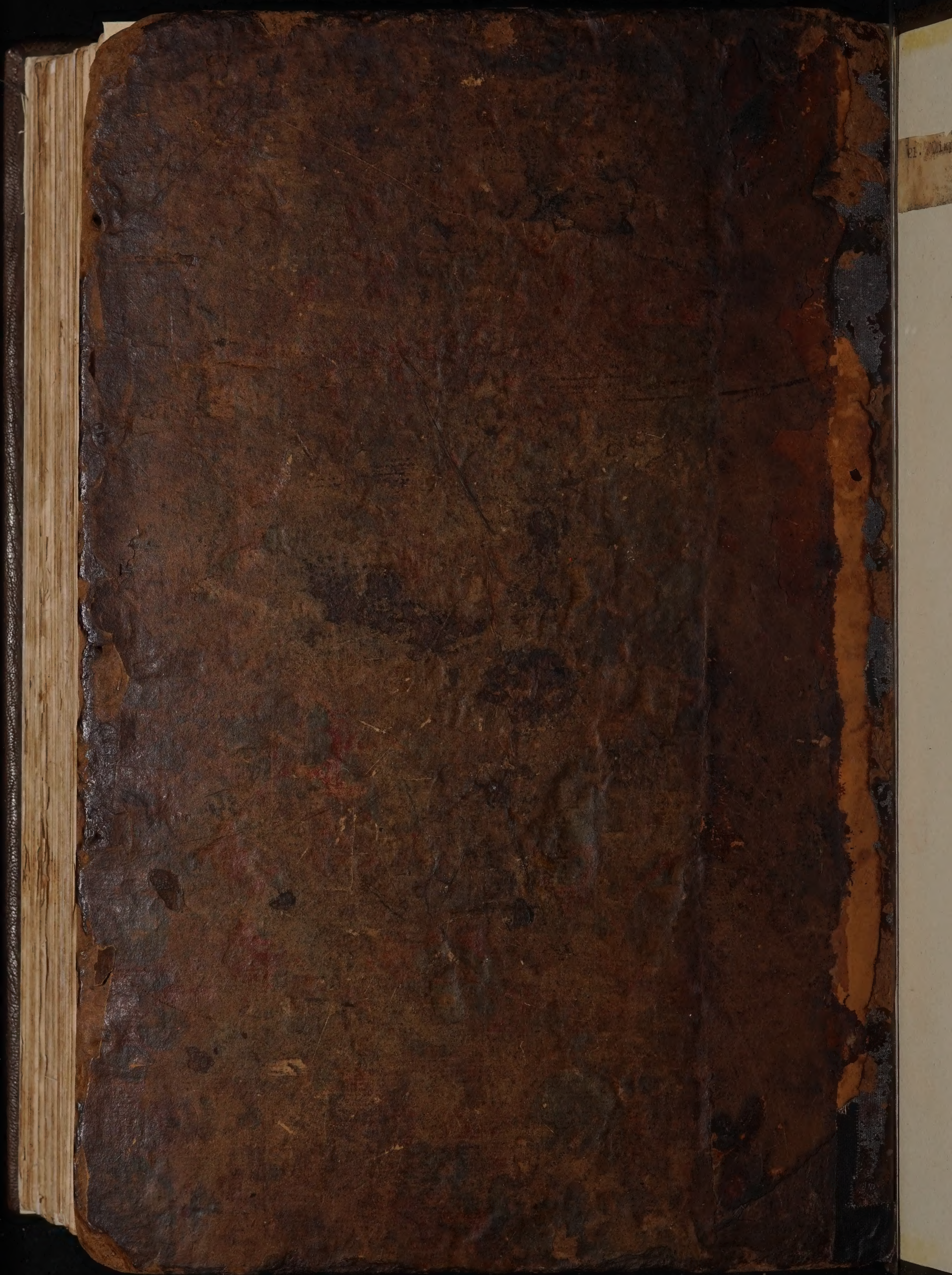
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Pl. Mikpokoz moppia a description of the body of man by Hilkiah Crooke
Dr. of Physic. Engravings showing various operations. 1631.

